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A radio ahvays at "Concert Pitch"

And this superb tone remains constant...thanks to the Permaliner, which maintains the origizal alignment of the radio ... keeping the set at "concert patch" year in and year out.

Perhaps most dramatic of all is the Sentry Box... controlling as many as five separate broadcareing bands... headquarters of a mystic sentinel that you'd expect to find only in "The Arabian Nights."

He is stormed by a thousand and one radio waves...all demanding entrance. But he premits only new wave to pass—the one to which your set is dialed. All others must keep our—and keep silent.

To the new General Licetic Radio, these exchasive "House of Magic" features give a brilliance and fidelity of tone that will delight the most enacting ears.

Performance lastingly brilliant

They give, as well, another quality that you'll appreciate more and more with the passing of time—a lasting brilliance of performance that defer the years.

The New 1936 General Electric Radio is now on display at your nearest G-E Radio Dealer's. In many smartly styled models table sets and consoles. Priced from \$34.50. (Prices slightly higher in the West, Mid-West NEW METAL TUBES ... sound, officient, long-lived ... designed to most modern broadcasting conditions, aboveware and long-wave alike,

and South, and subject to change without notice.)

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The new 1936 GENERAL @ ELECTRIC RADIO

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NO NEED TO BE JEALOUS OF HIM!



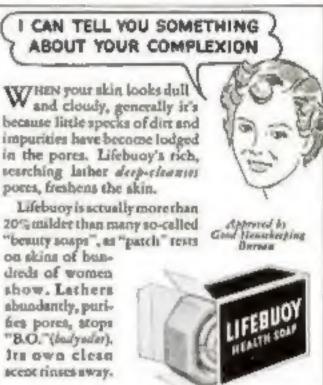
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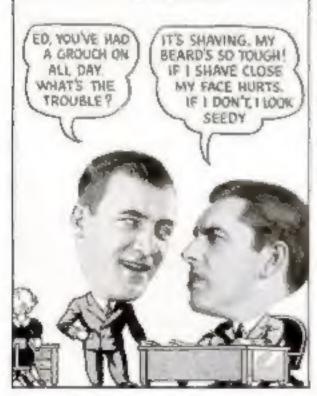


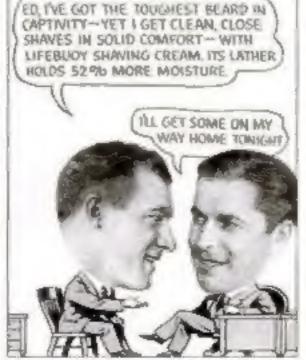






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COMPRESSION JOINT NEEDS NO THREAD Armored rubber garkets grip the pipe code in this case plumsing union to give a flexible connection that is permanently right against steem and gas as well as water. It is sold in coned on any steel pipe

New Ideas for Home Mechanics

TO BULKY and expensive threading tools are needed to make pipe repairs and improvements when the new compression-type coupling shown is used. These novel, self-contained pipe joints can be applied easily to plain-end pipe to give a flexible yet permanent connection. A wrench is the only tool required for the work. Two armored, rubber-compound gaskets, forced in as the ends of the coupling are tightened, grip the pipe ends to form a union that is leak-proof against steam and gas as well as water. Sold in a variety of sizes, they can be used wherever steel pipe is employed.



STEEL SHINGLES FOR OLD OR NEW ROOFS

With the increased use of steel for decorative as well as constructional purposes in the small home, shingles of thin steel are fast gaining in popularity. They can be applied over existing wood shingles or on the aheathing of a new roof with equal case and their rigidity and special locking edges provide a dorable, sag-proof roof.





SPRING WEATHERSTRIPPER SEALS DOOR BOTTOM

Being entirely automatic in operation, a new weatherstripping device for interior doors insures a light fit between the floor or threshold and the bottom of the door, It is designed especially for use on hedroom doors where a good air seal is needed in winter to prevent the cold air from open windows from cooling off the rest of the house. As shown in the cutaway view, the weatherstripper is installed in a parrow groove cut in the bottom edge of the door. A pin projecting from the binge edge of the door strikes a stop in the jamb when the door is closed. This forces a piece of soft weatherstripping into snug contact with the floor and provides a tight seal. Because it is spring-controlled, the weatherstripping cannot bind and it adjusts itself to any irregularities in the floor. According to its manufacturers, the fuel saved through the use of one of these spring bottoms on a bedroom door will pay for the installation in sixty days,



TRANSPARENT COMPOUND WATERPROOFS SURFACES

Province protection against moisture for almost any porous surface, a new transparent waterproofing compound recently developed can be applied with either a brush or a spray gun. It can be used to damp-proof wood, brick, concrete, canvas, rope, stone, and a score of other materials, making it a useful addition to the home owner's paint shelf. Even auto tops, shingles, trunks, and tents can be waterproofed with the colorless mixture and when applied on stucco it prevents disintegration. It also can be mixed with point for appliestion as illustrated. Marketed as a liquid in cans, it can be applied at any temperature.

uestions FROM HOME OWNERS

Q.-WHAT is the best method of ridding a house of red ants?-T.F.D., Trenton, N. J.

A .- A method tested by the Bureau of Entomology, U. S. Department of Agriculture, consists of making a solution by dissolving one pound of sugar in one quart of water and adding 125 grains of arsenate of soda (a poison). This mixture then should be boiled and strained. When it is cool, dip a few small sponges into the sirup and place them where the ants can get at them. When they are covered with ants. dip them in boiling water, redip them in the sirup solution, and repeat the operation, The boiling water will kill any ants not already dead from the poison.

Right Height for Steps

R. S., Los Angeles, Calif. In properly designed steps, the rise, or height from one step to the next, is generally eight or eight and one quarter inches. If a larger rise is necessary, the width of the step should be less.

Cutting Glass to Fit

H. P., CHICAGO, ILL. When cutting small panes of glass to shape, it is best to place the glass right over the frame so that the glass cutter can be run directly over the edge. Experienced cutters can follow the line by eye, but the amateur should use a straightedge.

How a Man of 40 Can Retire in 15 Years



T makes no difference if your carefully laid plans for saving have been upset during the past few years. It makes no difference if you are worth half as much today as you were then. Now, by following a simple, definite Retirement Income

Plan, you can arrange to quit work forever fifteen years from today with a monthly income guaranteed you for life. Not only that, but if you should die before that time, we would pay your wife a monthly income as long as she lives.

\$200 a Month beginning at age 55

Suppose you decide that you want to be able to retire on \$200 a month beginning at age 55. Here is what you can get:

1 A check for \$200 when you reach 55 and a check for \$200 every mouth thereafter as long as you live.

This important benefit is available alone: but if you are insurable, your Plan can also include:

3 A life income for your wife if you die before retirement age.

3 A monthly disability become for yourself if, before age 55, total disability stops your carning power for 6 months or more,

It sounds too good to be true. But it is true. There are no "ratches" in it, for the Plan is guaranteed by an \$4-year-old com-

a billion dollars of insurance inforce. If you want to retire some day, and are willing to lay saide a portion of your income every month, you can have

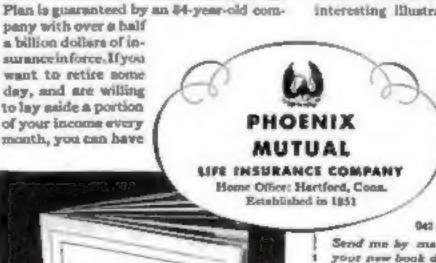
freedom from money worries. You can have all the joys of recreation or travel when the time comes at which every man wants them most.

The Plan is not limited to men of 40. You may be older or younger. The income is not limited to \$200 a month. It can be more or less. And you can retire at any of the following ages that you wish: 55, 60, 65, or 70.

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Our Readers Automobile Tire Tube le

Life-Saver to Tropical Fish

IN a recent issue of your magnzine, F. M., of Brooklyn, N. Y., asked how he could make a mechanical aërator for a tropical-fish tank. The simplest and most effectual accutor I have

seen is made from the inner tube of an antomobile tire, a long piece of rubber tubing, and a piece of wire. After inflating the tube, the valve is unscrewed slightly to permit a small leak and then the rubber tubing is forced on the valve stem. The wire is fashioned into two loops with a book



bent into one end. The hook fastens to the side of the tank and the rubber tube in passed through the loops. If the tubing is supported to that the end of it rests in the center of the tank, this arrangement will aërate the water sufficiently for most of the species of tropical fish kept by amateurs. The apparatus can be made more efficient if a short piece of glass tubing, which has been drawn to a point on one end, is inserted in the tank end of the rubber tube - F S H., Jerneyville, Ill.

When Opposing Lawyers Use Same Ammunition

WILLIAM WOLF's article on poisons and their analysis in connection with crime was most interesting and informative. However, when he states that there is a positive test for blood stains, I wonder. In the David Lamson murder case tried for the second time this spring at San Jose, Calif., both the prose-cution and the defense experienced difficulties when the question of positive blood tests was encountered. Most of the tests mentioned in Mr. Wolf's article were used both by the state and the defense. When the state experts were on the stand, a particular test would, it seemed, prove beyond doubt that the stain was bined but when the defense experts lestified, the blood test did not appear to be conclusive proof. In there really a positive test for blood stains?-R.G.B., Palo Alto, Calif.

You'll Probably Get It In Cellophane Wrappers

Brast hearing quite a bit lately about "so-

lene," the recently developed solid gasoline. and its many advantages over the wellknown liquid type. What gets me is how service stations are going to take care of fulling automobile gas tanks with the stuff. Will gas tanks have to be designed like airtight refrigerators with large hatches or doors?



How will the station attendant sell five gallors (or will it be cubic feet)? Or will be cut it from a huge cake like an ice man does ice? -G.S., Chicago, Ill.

Just an Instance Where Nature Took No Chances

Approxis of the question raised by E.F.C., of New York City about why we involunturily jump or give a start at any unexperted loud noise, I would like to submit my opinion, Mother Nature didn't trust the muchlouted wisdom of man any too far. So she outfitted him with a set of reflexes which work independently of his will. Messages coming from the nerve endings must pass through the spinal cord. Any unexpected message of pain or alarm, instead of proceeding to the brain, merely jumps a gap between the sensory and motor nerves in the spinal colump. This saves times and gets more effective results. Even though the cars are close to the brain, the message they send must make the spinal-cord circuit where it is in-tercepted and made a reflex in the case of unexpected alarms.—I.H., Wurusster, Mass.

Visits South America With One-Tube Set

EVERY have of your magazine during the post three years (that is the time I have been

taking it) has been a good one. I like most of all the articles on model building and radio. I built the onetube set described in the June, 1934, insue and I have had Bogota, Colombia, several times. Reception was as good as with a four-tube set. I have many other distant stations on my leg.



Piesse keep the magazine as it is and disregard the displeased,—U.L., Valdosta, Go.

He Wents To Call A Spade a Spade

The small item in your September issue bringing out the fact that there is no cat in catgut set me to thinking about a lot of other English words that don't mean what they say. For instance, there is no lead in a lead pencil. Most trolley cars have no trutleys lost under-rail shoes. A file card isn't a card at all, but a wire brush. The center of gravity is rarely central, and nickel coins contain about three times as much copper as they do nickel. We strive for accuracy in business and science, why not a little accuracy in our words?-G.D.S., Boston, Mass.

Raises His Voice In Defense of Vivisection

IN THE August issue of the magazine, B Mck., of Australia appeared to look upon vivisection as a detestable practice. Without this research upon lower azimals, however, medical and surpical science would suffer a great loss. Although much time and money has been spent upon cancer research via vivisection, it has not gone to waste. I believe in a few short years the true virtue of these ex-

periments will yield a profit to all mankind. Many lower mammals have fundamentally the same structure as man, so that research with animals can very well be used in the fight on human diseases. - S.Z., Darby, Pa.

Seat Covers Cause This Woman To Rise and Remark-

WELL, Mr. Editor, get on the defensive hecause I am after you. And from my view-

point there is no de-I'm writing fettse. about that article in your Helpful Hints for Motorists telling of the use of not one set of seat covers but two! Of all things. Putting one set of seat covers over the upholstery in a car is, in my estimation, an absurd act. It is about as sensible as a man



who, after buying an expensive and atylish suit, always donned overalls and Jumper when wearing it. We buy certain things in this world for their beauty as well as their utility. We are both stimulated and rested by colors and designs. Skilled workers in all branches of art strive to give us the best combination of these factors in many of the things we use. Automobile upholstery is one of them. I say out with your prison-stripe seat cover-ings!-Mrs. L.M.K., Paterson, N. J.

Answers Call for Cement To Fix Sun-Ray Bulbs

S.B.K., of Youngstown, Ohio, asked in the August issue for a cement which would fasten a loosened sun-ray lamp bulb to its socket. I would suggest the following: Mix litharge with plycerin until you have a mixture of thick paintlike consistency. This will hold the bulb tightly in place.—C.R., Queens Village, N. Y.

A Bird in the Jar Stirs Up Complications

REFERENCE to your recent Here's-the-Anproblem involved is not as simple as it might appear from that paragraph. A bird flying

into a large jar and around inside without touching the sides of the jar would create. I think, a problem of wind pressure from the flapping of the wings rather than one of simple weight increase. Should the bird, in circling the jar, attain a high rate of speed, its position would approximate a



ninety-degree bank, with all the pressure exerted against the side walls of the jar in a horizontal direction. How would that affect the weight (vertical pressure-weight on a

acale) of the jar itself? The problem seems to require pienty of calculus for its solution. A somewhat similar problem is created when a bitycle rider circles a vertical cylinder at a speed which enables him to maintain a course around the inner circumstrence of the cylinder. Does centratizal force exerting horizontal strains and stresses reduce the vertical components—weight of wheel and rider? For this I may incur the wrath of your mathematical sharks.—H.S.R., New Rocceile. N. Y.

Choose Your Weapons! He'll Take Swords

Not to be outdone by other readers. I've decided to put in a word or two about what

I would like to see published in the magaane. How about a few articles on awords and fencing? There's plenty of science to the art of defending yourself with rapiers and foils. To acquire the technique of an expert fencer requires good instruction and much practice. Drawings Wastrating the



various defenses and parner would be interesting and instructive. And, so a side light, there is the story of the manufacture of highgrade swords which is dependent on chemistry and metallurgy.—J H. Brooksyn, N. Y.

In Which Case the Nose May Not Always Know

I wast some enterprising scientist would give us the low-down on the sense of smea. What is it—a chemical function or a netve reaction like the sense of touch? According to recent tests, the sense of smell varies with the individual. What strikes one person as being a pleasant smell often is unpleasant to others. I for one, for instance, see nothing unpleasant in the whith of skunk you get as you drive along a country toud at hight. On the other hand, many flowers known for their heavy perfums are odorless as far as I am concerned.—T.D.Y., New Haven, Coun.

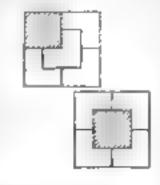
P S. M. Chairs Set Well In Rustic Surroundings

I Want to show my appreciation and tell you that your magazine certainly makes people happy. Recently I made several garden a sam of which the design, description, and particulars were given by Herman Hjorth. The chairs were made for a friend who has a bungalow at a Connecticut lake. In such a setting the chairs appear right at home. Please a intimue to give as more articles by Mr. Hjorth.—J.V.H. Riverdale, N. Y.

Here's How, Says Philippines To Australia

The problem of T.H.W., of Bexley, Australia, interested me very much and I hope to see more problems like it. I am enclosing sketches, giving my solution which meets all

the required conchitions. The problem stated that a farmer died, leaving four sons to inherit his farm which was square in shape. The conditions were that one quarter (a square) should be left for the homestead and the remainder divided among the four sons so that each would have a



prot the same size and shape as the others.—

B D M., Pangasinan, Phuppine Islands.

Where Your Money Goes Up in Smoke

"If wretter comes," was a thought which entered my mind the other day so I was moved to go down in the cellar and take a look at the furnace-with a furtive glance thrown in the direction of the empty coal bin. Well the old boiler, after a soot-removal job, will probably carry on through another season. Further, that trip into the cellar prompted the writing of this letter. The message which I wish the editor to relay before some of his ingensous readers is this. Most of the heat generated to a home furnace is wasted and only a small percentage gets into the house beating system even though it is kept in tip-top condition. With the approaching undespread use of air-conditioning for homes. there should be a great succutive to develop a combination beating and cooking unit which has a retainvely high efficiency and which can be produced at a price within reach of the average bouseholder. This is no new idea but I believe it is a tempting thought to lay before your amoteur wirards of chemistry, physics, electricity, and mechanics. I hope some one gets busy on this problem as quickly and successfully in your puzzle-solvers apparently go to work.—C.F., Rutland, Vt.

Cavitan's Daily Flights Make Reader Ass-Minded

You's article last month about Dr. John D. Brock and has daily flights interested me mightily. Here is a man who has really done something for aviation. Hopping the occurs and circling the globe are thrilling stants but they do not make the average man want.

to fly Penetrating the strate-place in metal goodstas may make but it still leaves John Citizen wanting to keep one foot on the ground. Now comes Dr. Brock for six years, every day in the month and every month in the year, he said into the air on his regular hop. For



2.000 consecut we days be his flown at least once. And all this without a serious accident Nothing I have ever read before made increalize the safety of aircraft today as much as that story.— R.N., Derver, Colo.

Well, He Needn't Worzy About the Change

JOHN D. ROCKEPLLEN, SR., recently entered into his mostly-accountly year. The September tisue of Popular Science Monthly carried an article telling that a German had developed an automobile which operates with wood for fuel as well as gasoline. These two news fiches, coming so close together, seem noteworthy to me. Will the elder Rockefeller who has lived to see the petroleum industry grow from its pre-motor infancy to its present gigantic size, live to see petroleum supplanted as the greatest source of power? It seems to me that fuel from some form of cellulose is a rational possibility for the not distant future These two events at least exaplusally can to our attention the swift strides that science has taken in our man's lifetume,--- D.C., Oil City,

Only One Cube Escaped The Paintec's Brush

My answer to the problem of EH of Des Mones, Iona is—sure, I can do it! The problem stated that small cubes were arranged into a soud larger cube so that each face of the large cube presented the sides of nine of its component small cubes. Then a cost of

paint was applied to the extenor of the large cube and their sestion was to state how many of the small cubes were painted on three aides, how many on two sides, etc. Here it is Early cubes were painted on three sides, twelve on two sides, say on one side and one was left uncounted.— A C C , Cleveland. Onto.

There's a Time and Place For Everything, He Learns

I have one objection to P.S.M and that is-it's so interesting that many a time I not

into trouble for reading it at the wrong time. Just the other day on my way home from work, I stopped at a newstand and bought the satest of tion. As soon as I was home. I sat down and began to read the macazine. Dinner was being prepared and I was taked to wotch a pan of fish frying or



the stove. During the next few minutes, my thoughts were enpeentrated on the magazine and not on the fish. I will spare you the scene that ensued but the net result for me, was no dinner and some scorchau reminders of how I had erred.—M.A.S., Baltamore, Md.

Would Hang a Crape On Decimal System

Title other day, in reading an old issue of Por tai Scale & Mexittee I came actions a fetter in which the reader proposed a system of measuremen, has no a unit equal co-Discuss Tive inches divided three 100 parts. May one number ask why of we are to make some change which will rationalize our system of weights and measures, we do not try the sentgesmal system? We already have it in un-Versal use for the measurement of a me and the division of the circle and earth's surface unto angles. The decimal systems render it ampier to multiply victors units but how about division? butly has more even divisors than 100 and twelve has more than ten. By adopting a sexage-imal system, we could discontinue the use of our statute mute and use the prographical mile which not only corresponds to one minute of longitude or latitude at the equator but is also nearly equal to 6,000 feet. The foot could be increased by one seventy fifth of its present length so that 6,000 feet would equal 6 geographical mile. This mile is always used at wa and by geographers. Our bushel, so little over one rubic foot in capacity, might be abandoned and the cubic foot substituted as our unit of dry measure - W F L., Stoux Falls, S. Dak

Here's A Suggestion for An Appealing Alarm Clock

A mast who won a hog-calling contest out here attributed his success to hog appeal in his voice. He said he seemed to promise the porkers something when he called. There's a

tip for inventors
When an darm clock
rings in the morning
it just wakes you up
It doesn't have any
appeal. It doesn't
make you want to hop
out of bed and come
running. It just brigs
or bongs or beares
Why not substitute a
phonograph-dish a rrangement to shout
breaktast or "come"



and set it?" Or why not have an aroma like hot coffer or becon and eggs arise when the bell rings? Putting appeal in the starm clock—there's a challenge!—E.B.A., Springfield, III.



EDISON MAZDA LAMPS GENERAL @ ELECTRIC You it the may be board by a "cat gain" houp, but the electric exe tells the reach. This marvelous is contac instrument proves conclusively that I discul Mazter houps stay brighter langer than beings of interior in action they give in section to every coller's within the electricity consome t

People are ptitifized that the process of a list the cost of the bulb park the cost of the bulb park the cost of the extensivity is as a Viriation pith those at all worth of the entity produce a dollar a work of the distribution, even if you get it for nothing

There a just one safe course to follow we en you look but par cook carefully at the trade-orack on the bush. If you tend this means grain 19 on the end of the lata you may rest assured that you are leaving good gill at low cost.

Cet a supply of these good Luips today. Prices are I west ever cess To for popular boosehold sizes. And you can out the confortable reading sizes. To an explowage for eals 20s. General Electric Company, Near Lark, Coveland, Olino.





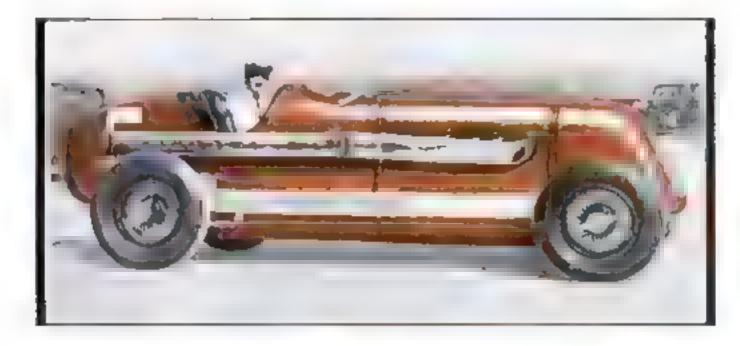
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POPULAR SCIENCE

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By EDWIN TEALE

PASTEST DIESEL ON LAND

In a Die-ol-powered racing car. C L Wild Br's Cumm nerenched the speed of 137 m los an bour at Daytona Beach, Plorida -second for this type of motor

Diesel Engines USHER IN NEW AGE OF POWER

HE other day, a red sport cor roacd down a street in Los An geles, Calif. It looked much like any other sleek 1935-model automobile. Yet, it was a princer as much to a covered wagon of the early days. It had blased a trail from coast to coast. It was the first automobile to cross the country un-

ter power supplied by a Diesel engine.

The six-cylinder Cummun motor under its hood ran on heavy fuel oil. For 3,774 miles, it had sent the machine over moun-

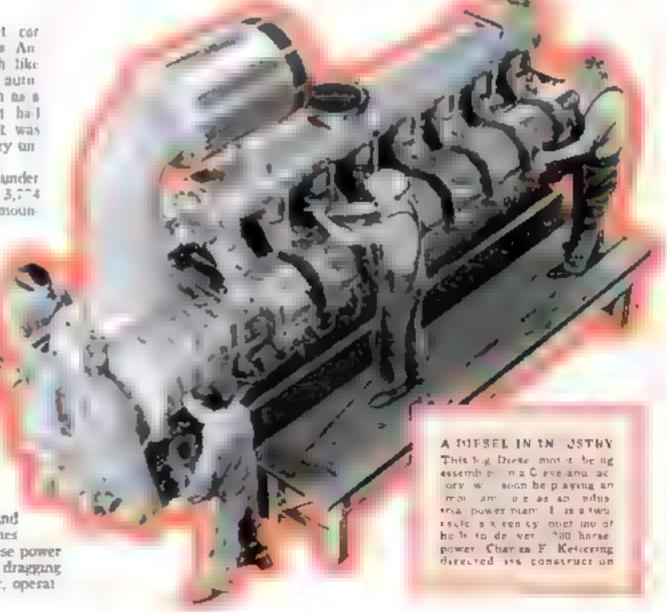
tains, through forests, across prairies. And the total cost for furl was only \$7.63-less than the price of a railroad ticket from New York to Boston

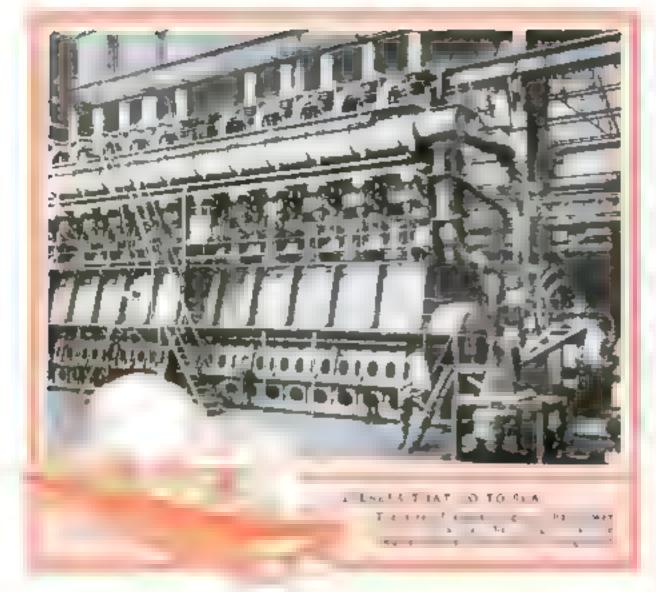
By another dramatic demonstration, the Diesel engine had given the world a glimpse of its posse-

bilities.

For decades, trained engineers have predicted an age of Diesels. Now, these power plants are coming to the fore with a rush. Streamline "bullet trains" rush over the rails both here and abroad, powered by Diesels. Grant metal planes sour on European airways, their propeliers mun by Diesels. And, in various parts of the world, busses and

trucks ride highways with Diesel engines roaring under their hoods. Besides, these power plants are pulling batteries of plows, dragging immense logs, producing electric power, operat-





ing canal locks, turning the wheels in thousands of factories.

In America alone, last year the installations of these engines totaled more than 750,000 horsepower. This year, it is expected to pass the 1,750,000-horsepower mark. Virtually every large gasoline-engine transfacturer in the country is now entering the Diesel field. During the last twelve months, the advance in these engines has been an outstanding event in the world of power

Because they have no carburetors or ignition systems, they are simpler in construction than guotine engines. Burning beavy fuel oil, with high temperatures required to ignite it, they are safer. Consuming less and cheaper fuel, they are more economical. And, in addition, they are more efficient.

Not long ago, an European manufacturer of Diesels set a world's record for engine efficiency. One of his marine motors

developing 5,500 horsepower, showed an efficiency of furty one percent. Compare that with the steam turbine's twenty-five per cent, the gasoline engine's twenty, and the locomouve's sail

With all its advantages, why has the adoption of the Diesel been so slow? To find the answer we must glance for a moment at the operation of this revolutionary motor.

If you have ever inflated a tine with a hand pump, you will recall that after a few minutes the pump became almost too hot to hold. Compressing air produces heat. This is the basis of the Diesel. The rising piston compresses the air within the cylinder to a pressure of from 500 to 1 200 pounds per square inch. This raises its temperature to 1,000 degrees Fahrenheit. At this point, vaporised fuel oil is sprayed into the superheated air. It ignites, just as the gasoline vapor does in an ordinary engine when the spork jumps between the points of the spark plug, and the valume of gases produced by combustion forces down the piston.

Because the pressures are infinitely greater within the cylinders, than in those of gasobic engines, Diesels have to be built with thicker heavier walls. This is the first handicap. The

PHENOMENAL DEVELOPMENT OF

NTERNAL - COMBUSTION POWER

PLANTS USING HEAVY FUEL OIL

PROMISES MORE ECONOM CAL

OPERATION IN MANY FIELDS

OF INDUSTRY AND TRANSPORT

weight of a Diesel is greater per horsepower than that of a gasoline engine. However, the use of heat-treated metals and new alloys is overcoming this disadvantage. The Cummins engine, for example, weight only 15 6 pounds per horsepower, as compared with the weight of a similar-type gasoline motor, which ranges from ten to 14 9 pounds per horsepower

A second disadvantage is the fact that Diesels are harder to start; greater effort is required to force the piston up to compress the air for the initial explosion. Balancing this is the fact that such an engine starts equally well in winter and in summer Other defects—none of them insurmountable—are that the Diesel has less smoothness of operation and sets flexibility than it possessed by gasoline engines. With a greater number of experts tackling these problems than ever before overcoming such defects probably will be only a matter of time

Behind this present activity has a strange story of achieventer and of neglect. A Minnesota blacksmith a German refrigeration expert, an American brewer, all played important parts in the drama of the Diesel.

About 1870, Christian Joergensen, a blacksmith in Minneapolis, turned out a curious predecessor of the modern orbourning Diesels. Two blocks of hard wood at the top of the cylinder rubbed together to produce the heat for the initial explosion which would start the engine. After that, the heat from the compression of the air kept the motor fring.

In West Virginia, a few years later, a mine expert named Tlmothy Havenand was tinkering with a motor known as the Coal Dust Producer." Instead of petroleom, it borned coal dust. For a number of years, it ran with more or less success. Then it exploded like a bomb, killing the inventor.

Coal dust was also the fuel used in the first engine tested by the man whose name is given to this type of power

plant, Dr Rudolf Diesel. Diesel was born in Paris, France of German parents. He studied in technical schools in England and Germany and at one time was manager of a large Paris refergerating plant. In 1893, he proposed his new type of engine working everything out mathematically on paper before buckling a model. Three years later, his first full-sized Diesel demonstrated its possibilities. Then, like Haverland's coal-



Huge farm implements, such as this giant seed drill which seeds

dust engine, this proneer of all the Diesels blew to pieces. Luckily, Diesel escaped with his life. After he got out of the hospital, he turned to fuel oil in place of coal dust. When his next engine was running smoothly, an American brewer from St. Louis, Adolphus Busch, was in Germany on a visit. He heard of the revolutionary engine and visited Diesel in Augsburg. So impressed was he with the demonstration that he purchased American rights and introduced the engine into this country.

Although engineers grew enthusiastic over the possibilities of the engine, the financiers cannily waited for Diesel's patents to expire. In 1912, they did. The following year, the story of this German inventor came to a tragic end. Completely discouraged, he committed suicide by leaping from a ship cross-

ing the English Channel.

How economical the engines are is revealed on the cost sheets of range concerns. Consider a few instances in

the realm of transportation

On the Pecific coast, when Duse motors were installed in four highway express trucks, they clipped \$2,000 from the fuel bills in a single month. On another line, a truck and trailer and thirteen-ton pay load on a round trip between Spokane, Wash., and Portland Ore., on eighty-seven gallons of oil. Other trucks on the same run sumed 210 gallons of gasoline. The crago price of gasoline in the United States is about a netern cents a gallons of fuel oil six.

One organization which operates twenty-one Diesel-powered trucks, at that ordered fifty more, saves approximately fifty dollars in fuel on every trip between Los Angeles and Fresh Calif. In ten months, a Diesel buered 130 000 mues—equal to more five circuits of the globe—and averaged nearly ten miles to the gallon of fuel while making speeds up to sixty mues an hour. Another bus, Laking Fritsburgh and

Philadelphia, Pa., covered 5,232 miles to sta first two weeks. It was on time at the end of every run, and it averaged eight miles to the gallon of fuel oil as compared with four and a half miles to the gallon of gasoline for the other coaches of the line.

The result? One American concern, which had barely 100 installations of its Diesei truck and bus engines in January 1934, had 1,000 by November of the same year? Another builder who turned out 1,056 horsepower in Diesel engines in 1931, reached 237,314 horsepower last year. Trucks powered by one make of American Diesels are averaging 4,000,000 miles a month. In 1931, there were only twenty-five Diesel busses in all of England. Today, there are 5 500, and mostly percent of the heavy-duty trucks carry Diesel engines. During the





fifteen acres an hour, are hauled by Diesel-driven tractors

twelve months of last year, the Diesels of one European manufacturer alone burned 25,000,000 gallons of fuel

Not long ago, a French motor-car builder announced a tenhorsepower Diesel runabout. Tests are said to have shown that fuel consumption is so low you can drive ten miles for a cent

In considering the question of economy, the important thing is the fact that a Diesel uses less fuel as well as cheaper fuel. When this type of power plant is widely adopted, the price of fuel oil undoubtedly will rise and added taxes may make it as expensive as gasoline. Even so, the inherent efficiency and economy of the Diesel will make it cheaper to run.

An American proneer in automotive Diesels is C. L. Cummins a mechanic and inventor of Columbus, Ind. His patented meter ng device which injects carefully measured amounts of fuel oil into the cylinders, gives smoother performance to engines he has installed in trucks, busses, boats, and automobiles.

In 1931, a racing car powered by one of his motors completed the 500-mile grind at the Indianapolis Speedway with out a stop. Using only thirty-one gallons of fuel, it pinced thirteenth. Last year another Cummins racer with Stubby'' Stubblefield at the wheel, crossed the line in twelfth place after another non-stop race. Cantinued on page 108)

Guarding Our Shores

A Never-Ending War Fought With

When rodent plagars rage in foreign ports suspected ships are scaled and furnigated to rad them of disease bearers

In the ship, mashed man regase a deadly gas. Here a chechanical cutter is being used to open a liyan de conf A single infected goat might prove the spark that would kindle the fires of disease over half a con ment

Today fast transportation—airplanes, automobiles, and fast steamships—brings the I nited States in ever closer contact with the life of the tropics. Down through the years, trade has left a ghastly trail of disease in its wake. With the African slave traffic came malaria and many other maladies. Yellow fever raged through southern cities for years after it had been suported, along with mahagany and rum, from the West Indies. Travelers from Canada brought germs which resulted in our last two severe epidemics of cholera

Trade with Europe and Africa introduced leptosy which was not uncommon in the Mississippi valley 150 years ago. Even today, Louisiana has a Federal leper colony. A century ago, European emigrants brought relapsing fever, now firmly entrenched among infected ticks in Texas and California where these insects form a constant source of human infection

truarding our nation against this menacing lide of tropical disease is a neversleeping watch maintuined by the U. S. Public Health Service and by workers of a few great universities. Recently, I visited the chief outposts along our westem frontier to see how science is aiding in the war against along diseases

This mouse injected with the germs of a limite known respect! I seems to a laboratory subject this role a to get its the fight against spidemics



ERROR swept across the high lands of Mexico, late in 1934, as a creeping obnoness struck inhabitants of thirty-live villages in the state of Oaxala, Back of the mys-

terious epidemic by a strange history

Borne by sultry tropic breezes a slave tradet sated into the West Indies one day two centuries ago bearing a pruiable cargo—scores of Airican negroes destined for the slave markets of the New World. Among them were blacks whose heads and bodies, covered with festering sores, gave hideous proof that their blood streams had become infected with thread ike, interescopic parasites from African forests.

In the steaming jungles of Guatemala, swamp goals, attacking the newly arrived, infected negroes, packed up these parasites and spread them broadcast among the gnat bordes of Central America. Ever northward crept the smoldering fires of disease until finally, in midsummer of 1934, swarms of the tiny, parasite-inden gnats invaded Mexico. They carried out their deadly attack so swiftly that a thousand new victims fell before a vigorous counterattack by the Mexican National Health Department began to bear front

Meanwhile, a thousand miles to the north, vigilant medical sentries watched the course of the dreaded malady. Would it continue to march northward, oversum ng North America as it already had spread through Guatemata and Mexico? Research workers of the University of Cantornia knew that high up in the mountain streams of western United States were ballons of Simulium flies, every one a potential carrier of the parasite.



The U.S. quarantine station on Angel Island in San Francisco Harbor an outpost of the Public Health Service. Arrivals from quarantiped ports are hald been fur observation.

Against Jungle Diseases

Test Tubes and Microscopes

Aboard a smoothly running government tag, I visited Angel Island, in San Francisco Bay. At this typical post, I saw how Uncle Sam's medical army, with test tube and microscope, polices our borders against invading germs. At one time this island medical fortress held in quarantine 4,000 people, just arrived from a port where an epidemic of cerebrospinal meningitis was raging. They were quarantined foorteen

days to permit any incipient cases to develop after which the passengers were released as fast as bacteriological tests cleared them

Later, I stood on the deck of a boarring cutter as it sped out of the quaran me station in Los Angeles harbor, to meet a Japanese oil tanker just back from a record-making trip to the Orient. As we came alongside, a crew of inspectors stepped across and ascended the accommodation ladder to the tanker's deck. Pub-



Securely held in the forcept is a "histog bug". This insect is a carrier of the parasise causing Chagas disease for which their is no known cure



Research workers prepare and mount specimens of tropical peresites for tolcroscopic examination.

ise Health Service doctors questioned the master of the vessel and the ship's surgeon as to whether there had been any sickness during the voyage

They studied the ship's bill of health which must contain the following information: kind of cargo, ports touched, and beatth conditions in each city and the surrounding back-country. Also, there must be listed definite data as to the last known cases of any of nine deadly diseases mentioned by the National Quarantine Act bushome plugue, Asiatic cholera, yellow fever, typhus, leprosy smallpot, anthrut, cerebeospinal meningitis, and postfacosis. The crew was then mustered and given a searching medical examination.

Meanwhile, an agricultural inspector searched for signs of plant parasites on the freight to be discharged. A representative of the Bureau of Animal Industries inquired concerning live stock which might spread disease to our azimal population. Because diseases of domestic and wild animals often spread to human beings, this inspection is important from a medical standpoint, although sometimes it introduces queer situations.

Such a case recently threatened international complications when one of the great Royal Netherlands mail deet made its first cal. at one of our Pacific ports. Aboard the bner direct from the Dutch East Indies, were three sacred cows carned to satisfy the religious rites of her Javanese crew Threstened with a lengthy quarantine, a protest by the ship's captain to his government was averted only when a mistake had been discovered in the ship's papers which had made it appear that the cattle were from a port where epidemic disease was prevalent

No animals were aboard our Japanese tanker, however, and the inspection was soon finished. Down from the most came the yellow flag, signifying that quar-

antine was over and that the ship, with a clean bill of health, might proceed to discharge her cargo.

From all parts of the world, a network of confidentia, information channels converges upon the Public Hearth Service headquarters at Washington, where the changing picture of world disease is constantly watched by experts. From American consuls in major parts of the world, from authorities of foreign countries, by mail, wire and radio, flow reports on health conditions. If cholera rages in Bombay a warning speeds to Washington and is relayed to all inspectors, who doubly scrutinize all vessels that have touched at any of the Indian ports.

Not long ago, a boat arrived at San Francisco from the Orient and underwent inspection in the regular way. Probably not one of the passengers noticed anything unusual in his communition. Yet at Honolulu a man had been taken off the boat, sick with smallpox, and that information, radioed ahead, put government inspectors on the alert for symptoms of the disease

As the government tug left the tanker's side and beaded back to the quarantine station, I beard (Continued on page 116)



The metal disks on the ship's however are typical of the shields that are placed on all mooring there is block the passage of rate

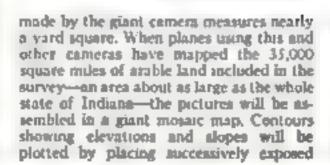


Camera thirthlied in a plane for use four miles above the earth

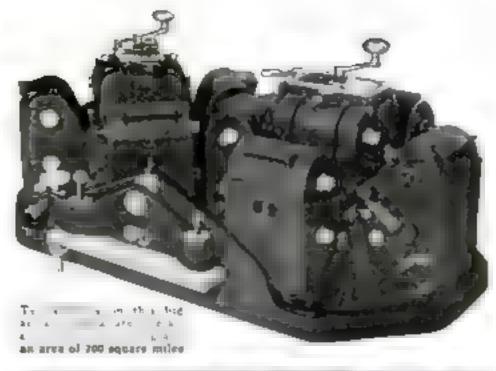
TEN-EYED AERIAL-SURVEY CAMERA PHOTOGRAPHS 200 SQUARE MILES

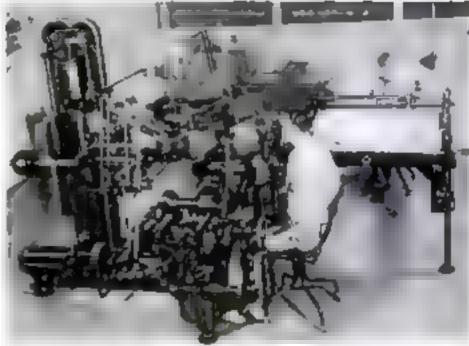
SPECIALLY designed for use in a soilerosion survey of the Rio Grande Valley in central New Mexico a new-type
nevial camera has ten lenses and ten shutters and will be used by an oxygen breathing photographer at a height of more than
four miles above the earth. Largest in the
world, the compound ten-lens instrument
shaps an area of more than 200 square miles
every time its shutter control is tripped.
Electricity operates the ten individual shutters in unison, and a neon light flashes to
warn the operator if any one of them fails
to function properly. The composite print

Right, using a bugs Muraoscope for plotting contours from serial photographs

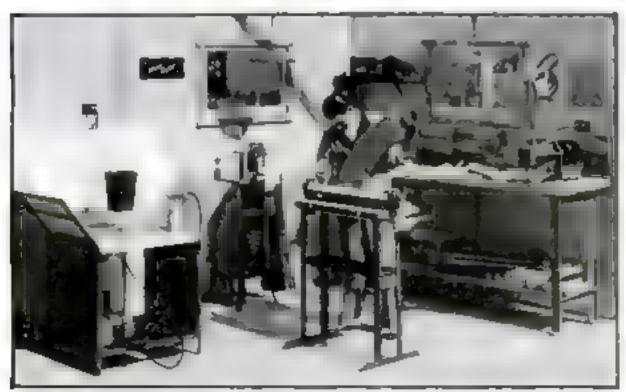


pictures, two at a time in a complicated machine that is, in principle, impry a huge counterpart of the old-fashioned parlor stereoscope, and similarly gives the effect of relief. From a study of the individual slopes of the rugged terrain, Federal agencies will determine what methods of farming and what engineering works will be most effective in combating erosion.





HOME OUTFIT FURNISHES SHOP FOR SHEET-METAL WORKING



Home metal-working outlit to use, It supplies all tools and accessories needed for this hobby

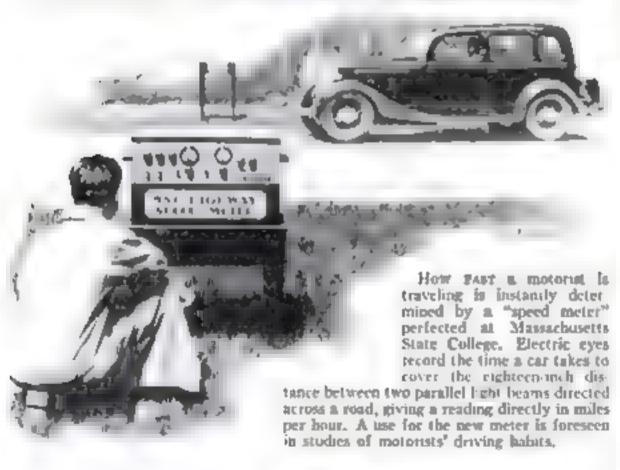
Working sheet metal, as a hobby, is made easy by the introduction of a contpiete home outfit for amaleur craftsmen. With its aid, a home-workshop enthusiast may construct a host of articles both of decorative and utilitarian value—tables, smoking stands, waste baskets, flower stands, fire acroens, bath-room cabinets, and a variety of other pieces limited only by the ingenuity of the designer Ordinary house current operates the small electric spot welder that is one of the features of the metal-working outfit, another is a metal jug shear with which intricate interior or exterior designs may be rapidly cut in metal. The shear is also capable of straight shitting at a speed of twelve to fifteen feet a minute. All necessary accessories are provided for bending, forming punching, and cutting flat stock one-twentieth of an inch. thick or lighter. A portable point-spraying outfit and spray booth, for applying the finishing touches to the hobbyist's creatsons, complete the equipment

MOTORS AND MAGNETS TO RUN HUGE TERRESTRIAL GLOBE

A GIANT mechanical globe being built for the world exposition at Paris in 1937 will depict the earth's continents and seas no an exact one-to-1.000.000 scale. Tiny ocean vessels, operated electromagnetically, will ply the principal trade toutes. By pressing buttons, the world's famous volcanoes will be set to action. Encircled by a spiral ramp for onlookers, the forty-three foot globe will turn realistically on its aus, and will be aighted by an artificial sun and moon.

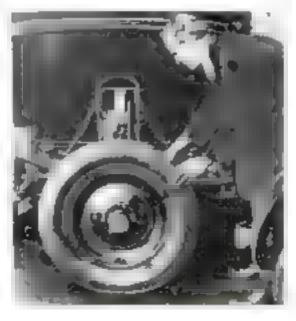


ELECTRIC EYES GAUGE SPEED OF CAR



SPARE WHEEL SWINGS CAR INTO PARKING SPACE

A MOBILE spare wheel, devised by a Hartford, Coan., inventor, aids in parking in a
cramped space. When the driver has nosed
his car as near the curb as possible, he sets in
motion a mechanism that drops the extra
wheel into contact with the ground. Power
from the engine then raises the tear end of
the car from the pavement and rolls it sideward, by turning the fifth wheel, to the curb
The procedure is reversed in leaving the parking space. All operations are controlled by
the driver without leaving his seat. The
photograph at right shows the inventor
pointing out the mechanism that lowers the
wheel and transmits power to it.





MICROPHONE GETS SOUND FROM ANY DIRECTION

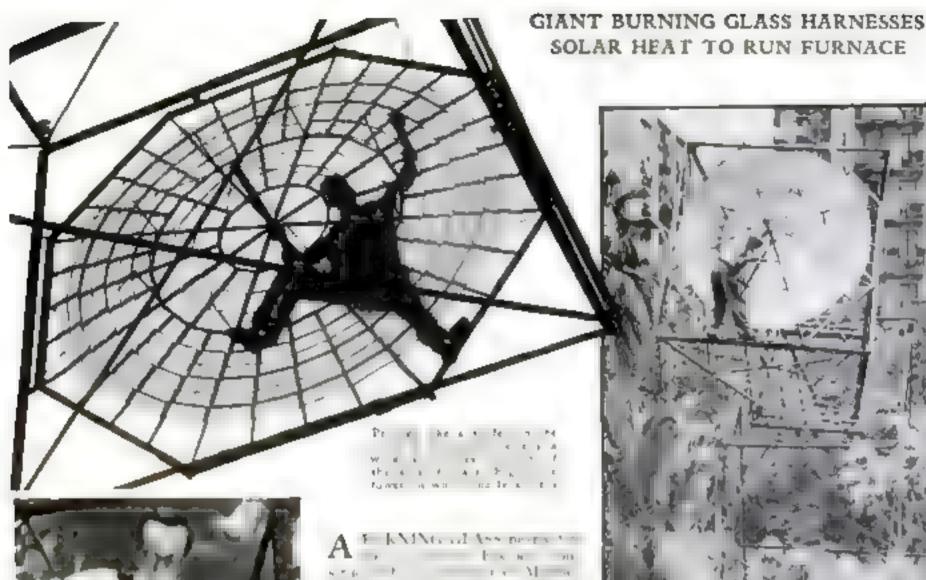
RESENBLING an apple impaled on a stack, the latest type of interophone to be introduced for use in radio broadcasting and sound recording is said to be equally responsive to sound from any direction, allowing performers considerable freedom of movement and grouping. Despite its unusual compactness, the new "make" transmits a wide range of frequencies without distortion and improved electrical characteristics permit it to be used several hundred feet away from its ampifier

HOUSE IS MOVED TO MAKE ROOM TO REPAIR IT



Footing created for workmen by moving house

Becates her house abutted upon a neighbor's property and the neighbor refused permission for ladders to be set up on her lawn, a Chicago home owner recently found herself in a quandary when the north wall of her residence needed repairs. She solved her problem by having the whole house moved thirty inches to one side, giving the workmen a footing, as shown above. At the completion of the job, she planned to have the house moved back again to its original position.

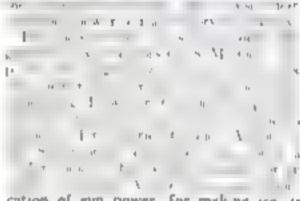




The inventor at the smelter box socated at the focus of the loop. The heat is as if to most metally

r 110 r rritare Pye a nather than I were and the state of t yes manual consider Int day T

proposes to erect a battery of twenty solar furnaces, each one many times the size of



cation of sun power, for making ice, is described on page 30 of this tisue.

HELICOPTER MAKES 100-MILE SPEED

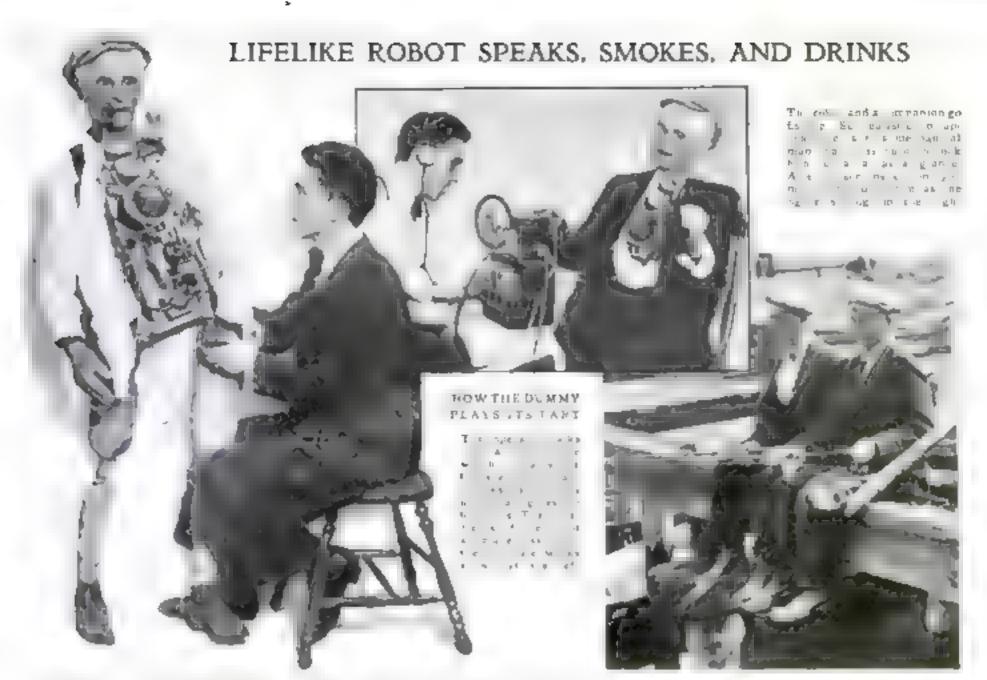
FIRST TREALS of a helicopter of new design, at an airport near Paris, France, are reported to have shown it capable of a speed of 100 miles an hour. Named the "giroplane," the queer craft is the creation of Louis Breguet, noted French airplane builder, and represents the latest attempt to produce a machine capable of maing straight up or of hovering motionless in the air. The picture shows it in flight.





CAMERA OBSCURA SPOTS BOMBING AIRPLANES

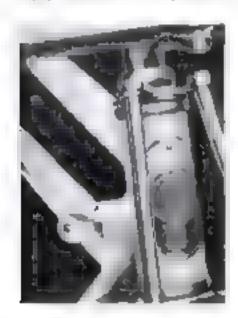
A TURRET-SHAPED camera obscura has been installed at Hamilton Field, Calif., to follow the maneuvers of bombing planes. A wide-angle lens in its top projects images of succraft upon a table map, enabling an observer within the chamber to check their position with accuracy



SINGING, amoking, drinking, and holding an animated conversation are some of the accompushments of an amazing mechanical man designed by Milton Tenenbaum, of Brooksyn, N Y. Controlled remately from a concealed point of vantage, the robot is operated by built-in

electric motors. A rubber bulb, alternately squeezed and released by a motor-driven cars, enables the automaton to puff a lighted pipe realistically. Compressed air stiffens or relaxes its legs. Words addressed to the robot, picked up by its hidden microphone, are carried to the

distant operator, who replies through a loudspeaker in the dummy figure. Meanwhile the lips of the figure move in a bielike fashion. The creatur of the me chanical man, a young sculptor, proposes the use of figures of this type in animated movie cartoons.



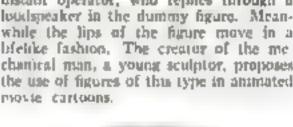
BULLET-FIRING AX DISPATCHES GAME

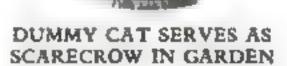
An ax that fires a buliet bas - 1 signed for hunters and campers Uppos the nix-inch blude ji g chamber that 🦠 🦠 be loaded with a 32-20 calibre carry ... which is normally held away o stationary firing pin by a coil specific blow with the ax on the head of a continue deer or bear produces enough concussion to set off the load, dispatching the minute instantly. There can be no mi es. In the test illustrated, a bole was blown in a bacrel top.

BICYCLE HAS STEERING LOCK

A LOCK permanently built into a bicycle of new design securely clamps the steering post to guard the machine against theft. Patterned after types used in automobiles, the lock is of five-tumbler design and is declared to be proof against picking or tampering Its use dispenses with the makeshift padrock and chain, often used by cyclists.







A scareczow in new guise protects the garden of a Connecticut home owner against birds. Perched on a near-by tree trunk, an imitation cat keeps a watchful eve and is said to Irighten feathered visitors away from freshly planted seeds.

MINT AIDS DIGESTION

Takino mint candy or peppermint cordials after a heavy meal is a custom vindicated by modern science. Tests recently reported to the American Medical Association show that odi of peppermint which these contain, speeds up digestion and helps avoid the feeling of a distended stomach, particularly after a meal with a high content of fats.

Amazing New Substances



Lamp have of plastic material and the mold in which they are cast. Note the molding powder being poured into the mold. In oval, tablewers made of colorial plantics

HEN you look at the face of your watch, switch on the radio, press the starter button of your car, or unscrew the cap of your fountain pen, the chances are you make use of plastics—the marvelous synthetic materials that, in the last few years, have become vital to hundreds of industries.

Telephones, radios, chairs, dishes, buttons—all sort of useful articles, from steering wheels to surgeons' masks, from safety glass to fishing recla, from false teeth to bird rages, now are made, wholly or in part, of plastics. The magic of modern chemistry has produced these materials which are unlike any natural substances found on earth or in the sea.

Some plastics are formed of synthetic restas, others have bases of casem, indrocellulose, or cellulose acetate. In use, some plastics are molded, some cast, some laminated. They vary in characteristics as well as in origin. Some are affected by heat and acids, others are resistant to both.

Currously enough, it was the game of billiards that started, some surty years ago, the movement toward the wonders of modern plastics.

About 1870, a manufacturer of billiard equipment in New York City offered a prize of \$10,000 for a substitute maserial that could be used in place of ivory in the batts. John Wesley Hyatt a printer from the viltage of Starkey N V was one of the contestants. Night after night, he fussed in his makeshift laboratory, mixing chemicals, heating liquids applying pressures. Finally, he hit upon a new substance. It was celluloid, the first of the plastics.

Today, cellulaid has 25,000 uses and there are more than 300 other creat ons of the test tube in the plastics field. Their trade names add curious words to the modern vocabulary. Bakelite, Pyralin, Teni e Ameroid. Beetleware Plaskon, Durez, Catalin, Durite, Micaria, So important are these products that the Smithsonian Institution, at Washington, D. C., recently added an exhibit to show their creation and uses.

Some forty years after the printer, Hyatt, discovered celluloid, snapshot enthusasts all over the country contributed indirectly to the next great step in plastics.

A Belgian-American chemist, Dr Leo Backeland, had produced a superior printing paper for photographers. With money obtained from its sale, he financed extensive researches in a private laboratory at Yorkers. N. Y. Over and over again, he tried an experiment which had always ended in failure. He was seek or to combine carbolic acid and formaldehyde.

In 1907, a catalyser—a chemical agent



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A few of the 25,000 articles in which thermoplastic materials are employed

Synthetic Materials, Unlike Any Found in Nature, Are Created in the Laboratory To Meet Demands of Beauty and Utility

By JOHN E. LODGE

which causes other substances to react without entering the communition itself—enabled him to succeed. The material produced by the reaction was entirely new, hard, clear, yellow. In appearance it suggested amber, but its characteristics were quite different. In honor of its maker, the new substance was named Bakelite

Experiments with Bakelite revealed a curious fact. In its raw state, heat soft-ened it and alcohol dissolved it But when it was subjected to great beat, it hardened into a state in which neither chemicals not beat affected it. Some other plastics have a similar characteristic. It marks the dividing line between the two groups, the thermophastics and the thermo-setting plastics. The first group is affected by heat the second is not

In the first group, you have the plastics with a natrocellulose have, a cellulose-acetate base, or a casem or a vinyl-resin base. In the second, you find the laminated plastics, and the urea and the phenol-formadehyde resins. Celluloid is a representative of the first group; Rakelite of the second.

From these two groups come a thousand and one products to meet the needs of modern civilization.

Plastic substances now give us salt and pepper shakers, prano keys, birthday cards, animated curtoons, umbrella bandles, scuf fless heels, crow calls, imitation gold fish, tooth brushes, combs, magicians' apparatus, fishing bait, gavels, botel-room numbers, table-tennis balls, sword handles. thimbles, and shoe-lace tips. Shde fasteners made of

plastics instead of metal are now on the market. One of the queerest uses of plastics is in the manufacture of two-foot-long above horns designed to aid men who are too fat to bend over and put on their shoes'

Recently, the cast resins, which come in brilliant colors and mottled effects, have attracted wide attention. They are sold in rods, tubes, and sheets, and are employed extensively in the production of jewelry and art objects, Home-workshop enthusiasts have discovered that such materials can be worked almost as easily as wood. From them, they are producing book ends, lamp bases, drawer handles and dresser sets. Special kits, suited to the needs of amateur craftsmen, are now on the market

Skilled artists have made use of the new materials to produce delicately timted carvings. Effects impossible to achieve in wood are attained with the cast resin. Among its industrial products are chessmen, pipe stems, knife handles, bowling pins, and a host of ornamental objects.

It is estimated that three out of every ten automobiles carry plastic materials in their gear-shift knobs, radiator-cap ornaments, or cigarette lighters; that five out of every ten handles for picnic knives are made of the brilliant substances, and that seven out of every ten pieces of costume jewelry are formed of the same material.

In some instances, holes are drilled into the pieces of cast resin and dye injected to produce a striking coral effect. Factories which have batteries of valve wheels, side by side, are preventing mistakes by making the wheels of plastics, each in a distinguishing color. One of the latest products in this field is wood impregnated or coated with a synthetic resin.

Before they are treated with amiline dyes, cast plastics are transparent. Undived they are inding an expanding field of uses forming shatterproof crystals for watches and replacing glass in other articles. When a new restaurant opened its doors in New York City, not long ago, its most striking display was formed by neon tubes glowing within bars and sheets of tipted synthetic resin.

Behind the success of this rainbowtinted material lies a World War quest for

> Carving a bracelet from synthet a resin with a high speed cutting mechans Below, an umb elta head made from one of the many cast ten many plastics

Printegraphs Couldry of MUDGERS PLANTICS P.



synthetic rubber. During the last weeks of hostilities, the cubber shortage in Germany became acute. Chemists worked at fever heat to find a laboratory substitute. They faned Bull out of some of the experiments there developed the basic material from which the tast resins are produced

Although these belong to the thermoplastic group, they are able to withstand dry heat up to 275 or 300 degrees F. This makes it possible to use them for ash trays, regarette lighters, and lamp fixtures. Also, they are resistant to acids. Created in the laboratory, these materials are now going back to the laboratory in the form of superior heakers, flasks, and vials.

The cast plastics consist entirely of synthetic resins. The molded plastics, however, such as Bake ite, are mixed with follers, such as pulverized wood, ashestos, or mica, and placed in machines under tremendous temperatures and pressures until they flow and fill the molds. Because the temperatures destroy the arrible dyes, these plastics appear only in a few shades, generally plack. But a this color they are known in all parts of the civilized world.

They fly with airliners, plunge into the ocean in submarines, ride the sea as fire-proof fixtures on ships, appear in a thousand and one (Continued on page 111)

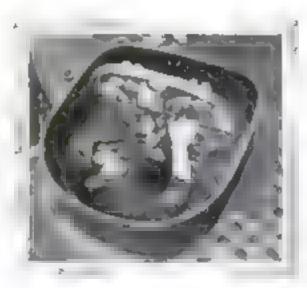
Undersea Battleships...

POWERFUL NEW SUBMARINES JOIN WORLD NAVIES



On the broad dech of the Narwhal a gun crew dril a with one of the two sex-inch goes monored on this formidable undersea cruiser. The buge ventel's armament also includes out torpedo tubes

with some of the latest undersen monsters this 235-foot craft at face displacement



The Namebal, one of Uncle Lum s largest submarines. She carr on a crew of a ghigright and can do severneen knots on hour of the eurice

ILL naval battles of the next war be decided beneath the seas? With Germany building submarines again. af er a sixteen-year apse imposed by treaty restrictions, the eyes of havil ub-servers the world over are turning once more to undersea craft and their potential value in future conflicts. Increased speed and cruising radius, together with powerful weapons for defense at the surface make them a puzzling factor in the problems of sea power

Compare recently built submersibles with the relatively small U-bosts that wrought havor on albed and neutral shipping during the world war and the startling evolution of the submarine since that time becomes apparent France's 400-foot Surcouf, largest submarine in the world today, is a veritable armored cruiser of 3,000 tons displacement; a pair of eightinch guns supplements its beavy battery of fourteen torpedo tubes, and enables it to cope with all but the most powerful of the enemies it may meet at the surface. Hurdly less formidable are the United States Navy's crusertype submarines Narwhal and Nautilus, 371foot monsters of 2,730 tons mounting six-inch guns; and its mine-laying submarine Argonaut about equal in size, carrying six-inch guns and sixty mines.

No longer is the wartupe role of a submarme limited to comparatively short raiding cruises from its shore base. Undersea craft of today are speedy enough to accompany a battle fleet on its maneuvers, participating in attacks and performing invaluable scouting missions. Their cruning radius is far more than sufficient to take them across an ocean and





By for the largest submarine in the world. France's giant Surcoul is a vorusible underees. buttleship It has a tures mounting two eight-such guns, and will carry an atrolone



Propering torpedore for firing, should the British L. 16. The man of the right to giving a projectile the 2 000-pounds harge of compressed act that would revert proper series

back again without refueling. Their newly acquired ability to defend themselves, if caught unawares upon the surface by hostile war vessels, enhances their ability to operate in comparative safety in waters

controlled by an enemy,

How keenly the leading world powers realize these capabilities of the modern submarine is shown by their development of this naval arm. So rapidly has France increased her underses power within the last few years that she now leads all other nations in number and tunnage of submarines. The United States ranks secend in number, and third in tonnage. Figares revealed not long ago by the Office of Naval Intelligence at Washington, D. C., give the following totals of submarines built and building: France, 11., United States, minety-four; Ita v seventyfive, Japan, seventy-three; British Empire, sixty-four. The corresponding tonnages, in round figures, are: France, nearly 100,000 Japan, 88 000, United States, 83,000; British Empire, 64,000, Italy, 52,000. From other sources, Russia is unofficially reported to be building some sixty submarines of about 800 toos apiece; while Germany's announced plans call for twenty-eight "pocket submarines" of from 250 to 750 tons.

Views reproduced on these pages give a vivid impression of the power of modern supersubmaranes. Their interior details are carefully guarded secrets; but recent photographs made by special permission aboard an earlier type—the British submarine L-56—afford a glumpse of the mase of machinery below decks that propels such undersea warships and launches their death-dealing torpedoes.

The U S S Cuttlefish. I 110ton submarine of recent design. This underson fighter has a surface speed of seventeen knots Allove is are pictured he Base and the Bonsnrie 2.000-ton prototypes of the is ger Norwhal and Naurelue The Ress carries a three-rock antiacreral Laws

The gun crew of the L-36 prepares for action. British submarines of this class are armed for enrigge fighting with a four tock gun, as shown, and a machine gan

Traps and Boats Save Starving Moose

A phora of Oc. the

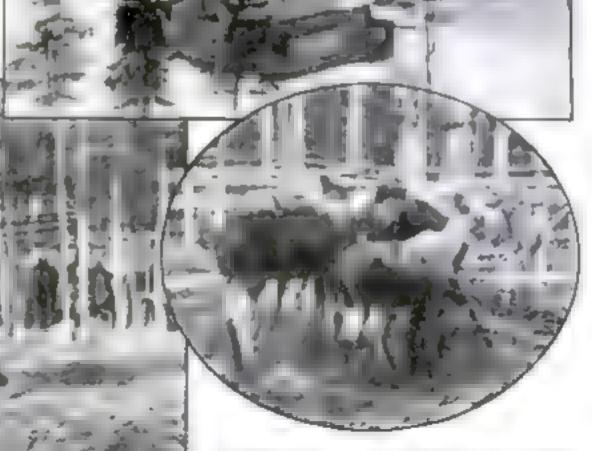


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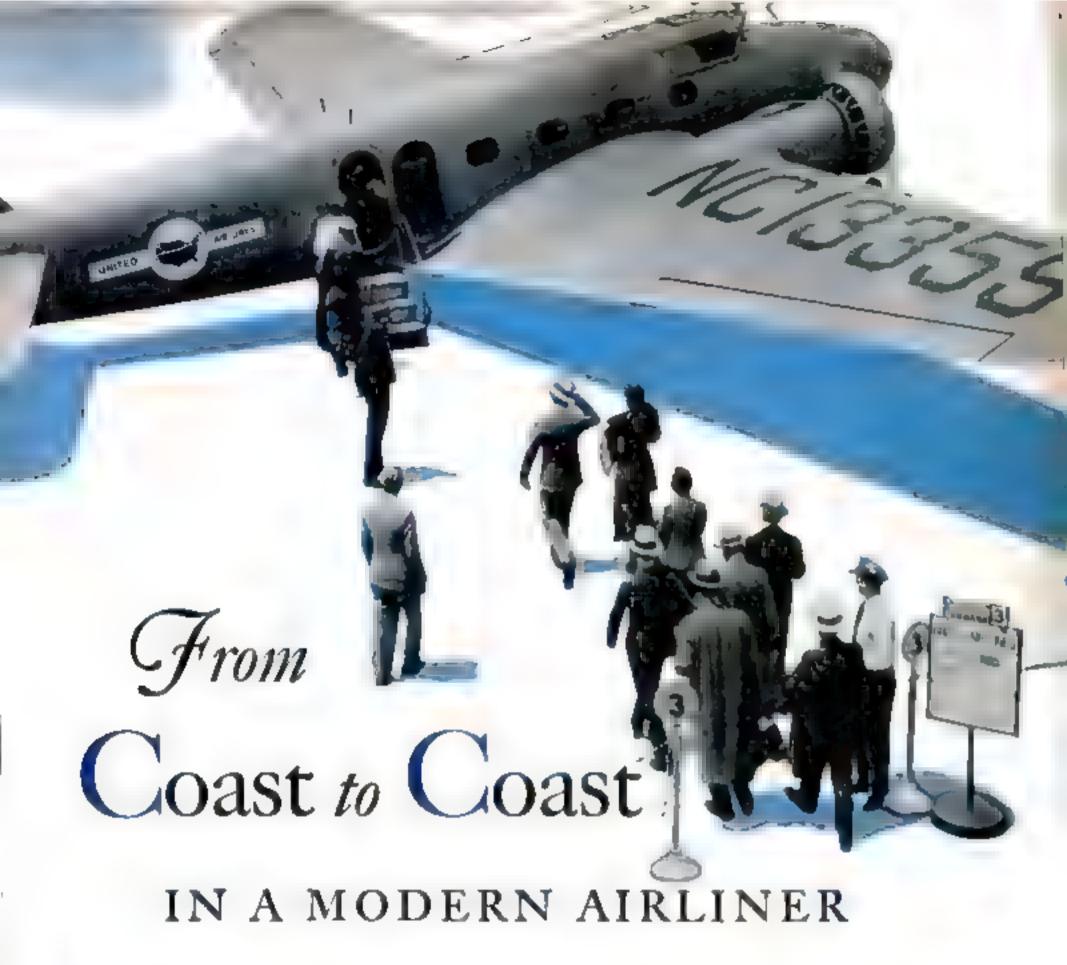
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HE other evening I heard a business executive give his opinion of the passenger air lines. "Air travel," he said, is just

"Air travel," he said, is just a fad. When the air lines are perfected so that they come within reach of the average man's pocketbook when they deposit the Philadel-phia-bound passenger in Philadel-phia 100 times out of 100 instead of in an isolated cow pasture, when they become really safe—we'll use the air lines. But," he added, triumphantly, "that will never come in our day"

Partly true, but only partly true. The 1935 air lines are not 100 percent safe, they are not yet 100 percent dependable: they are not quite within the reach of the average man's pocketbook. But neither are the railroads, steamship lines, bus lines, troiley lines, or private auto-

salety, dependability, and cost now

mobiles.

The air lines' utopia is almost within grasp. Their record for

compares favorably with that of other forms of transportation—and it still is due for a big improvement. Virtually every major problem of the air lines has been solved within the last five years.

Witness just a few of the inventions and improvements in aerial equipment the last five years have brought forth: the radio beam, the adjustable-pitch propeller ice-ternoving equipment, improved weather-forecasting methods, radio blind-landing

MARVELOUS MACHINES SET A NEW STANDARD OF COMFORT, SAFETY,

AND SPEED IN AMERICAN TRAVEL

By George R. Reiss

equipment, the robot print, more powerful motors with less weight, and improved streamline design.

All these have put American air transportation on so efficient a basia that lines last year inaugurated mateens to twenty-hour transcontinental service at least five times as fast as the best rail service, and established fares that are almost on a par with rail and Pullman fares. Major lines completed on time amery-five to maety-

ome percent of all scheduled trips and your chance of getting killed, if you flew only on major lines, was not over one in 50,000,000 for every mile you flew. In fact, you took a much bagger risk in your automobile

Travel with me on a major air line to see how these new inventions work. Ride with me from New York to Los Angeles on the "Sky Chief," the fastest coast-to-coast schedule.

I put my money down on a counter at New York and request, "One ticket for Los Angeles."

What do I get in return? I get speedy, comfortable, and safe transportation. By rail, I would leave Sunday afternoon and arrive in Los Angeles the following Thursday. By air, I reach my destination Monday morning. By rail the fare is approximately \$134.50 including lower berth, meals for four days, and tips. The air fare, including my taxi bilts, is \$161.50. For \$27 extra I have saved four days.

And what does it take to transport me? It takes a gigantic machine that clicks with the precision of a high-grade watch. It takes an \$80,000 airptane, four transport pilots, mechanics, dispatchers, clerks, weather observers by the score, five big airports, a dozen radio stations, more than 100 emergency fields,

and 500 airway beacons.

At the surport, our place is waiting, an eye-filling sight. It is eighty-seven feet wide, weighs nine tons, and embodies all the atest features in streamline design and safety features. It gives a feeling of great strength, of security, like the George Washington Bridge

The plane is ready. Hundreds of gallons of gasoline have been poured into the big tanks, every bolt and nut has been inspected and Lightened, the radio has been tested, the whole outfit has been passed by the ground staff, and the engines have been warmed. The baggage and the air man have been slowed in the

ample cargo batches back of the pilots' cockpit and in the tail.

The weather looks doubtful, it is raining hard, and it seems hardly a fit day for flying; but the pilot doesn't look worried. One bandred miles away in the mountains, "Hel. Stretch," it is loggy, but we shall see none of it, and at Pittsburgh the sun is shining.

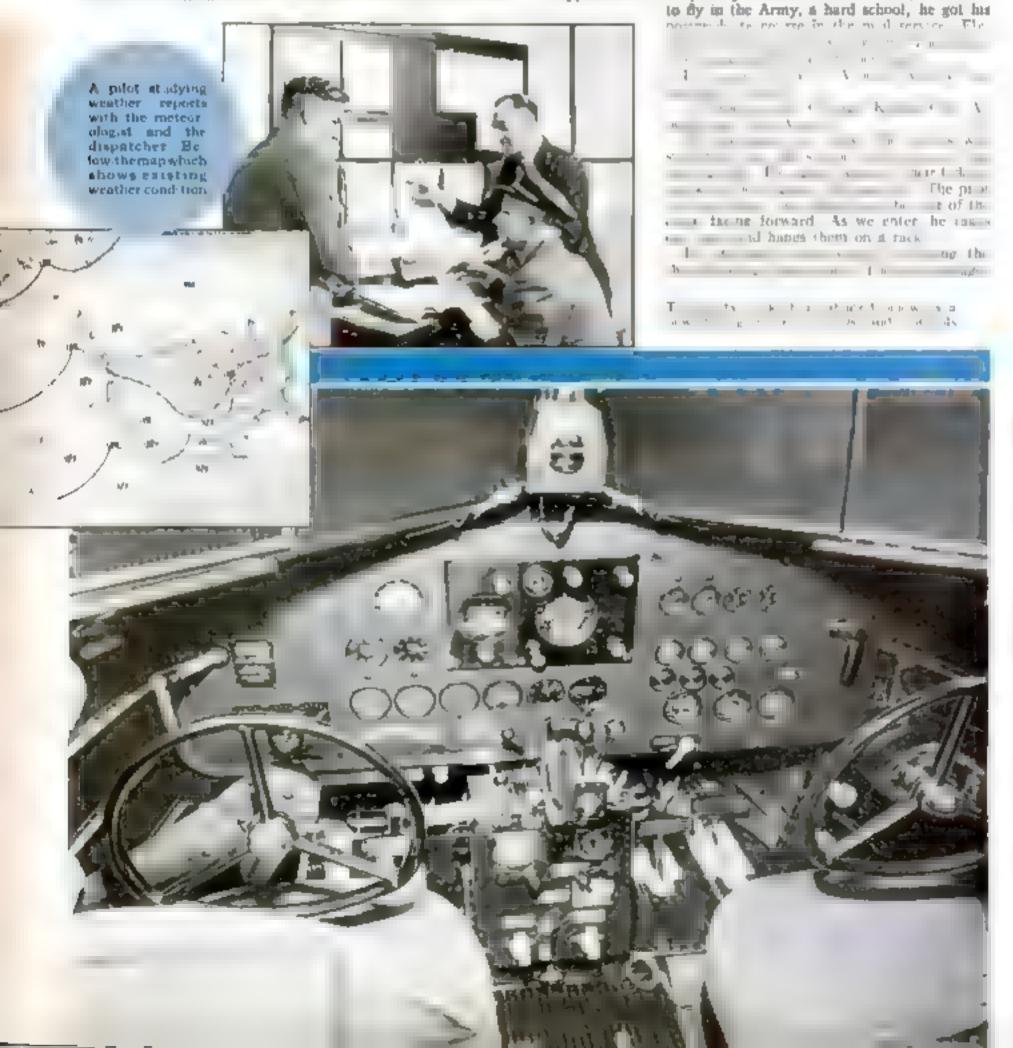
In the operations office, our pilot is studying the big map which shows weather conditions in every corner of the United States. A teletype machine chatters with additional weather reports from the score or more of meteorological stations strong across the Jersey plains, through the Alleghenies, over the flats of Ohio and Indiana.

If the weather were doubtful, the plane would be held. You might fret and lume: you might threaten to sue; yours might be a life-and-death errand, but the plane would be held until the situation cleared up. In aviation, there is no such thing as, "I guess we can make it," or, "I hope we can make it."

But, this time, the pilot is satisfied; the field manager is sat-

ished; they sign clearance forms.

But here a word about the most vital element of this gigantic system, the human element. Our boss pirot is a straight clean, well-built, military-looking man about thirty-five years old. He is typical of the boss pilots you find on these air lines, he learned



eves his wrist watch then the pilot, then his hand drog

The door is slammed the maters rear and the ast so the ast crete apron.

At the end of the runway th bilor person as person a Tracks of the same of the same rgst & a heath 1 47 h rsc shall a to the state of the SDILL K HE E WILL at the still talks te six s in the real et als first to the hi it iii. property to buy a

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Interpret of the cat prof a modern airbust. None and when in an enforced to be decimally and the temperature is a atomat, ally controlled. liches a gener transport place in flight with to wheels set acted into the ring or parelles

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justing their scale and furnishing prilows to those who want thera. Then he retires to the cockpit, leaving the door open

Now we may examine our surplane. It is the latest and finest triumph of the aeronautical engineers. It is as far ahead of the 1925 plane as the Twentieth Century Limited is ahead of the Lincolo funeral train, as far ahead of Louis Bleriot's cross-channel plane as the latest streamline train

is ahead of the Pony Express.

It is a low-wing, all-metal monopiane, with two 700-horsepower motors jutting forward of the wing. The cabin is a buge affair. There are fourteen scats, big, upholstered, adjustable seats as comfortable as the overstuffed furniture in your living room. Beside each is a reading light, an ash yent, a push button to summon the conflot, and a nozzle to regulate the flow of air. At the rear of the cubin is a lavatory and the kitchenette

No matter what the temperature may be out-





doors, there is a constant temperature of seventy degrees to the cabin. It may be twenty below outsideand it frequently is at 14,000 feet -but it remains seventy inside. The cabin of the plane is steam-heated and air-conditioned.

The expected thundering of motors is missing. You may talk in normal tones. In fact, the copilot tells us the pilots frequently must ask passengers at night to talk in lower lones so as not to disturb their fe low travelers

who are sleeping

This is the result of soundproof construction, the rubber mounting of he engines, and the fact that the hree-bladed propellers are geared to revolve at comparatively low speeds

Each of the two motors can supply power enough not only to keep us a oft but to climb. If a motor fails in flight, we can continue the jour ney Failure of one motor is unusual a lure of two motors is virtually unheard of. And motor failures are becoming increasingly rare

In the air the wheels retract into the engine nace les. This cuts down resistance and increases the plane a speed by twenty-five or thirty miles

an hour

One of the most remarkable features of this plane is its adjustable. pitch propeliers. These are regulated by the priot from his cabin to give the greatest possible efficiency. In taking off, he adjusts the properers to low gear, or low pitch, and gets maximam power, just as you put your automobile into low gear to climb a steep hall, in the thin air of high al-

titude he shifts to high pitch so that the propellers take hig-

ger lates and the plane gains maximum speed

Another feature is the wing flap or air brake. This is merely I hinged section of the bottom of the wing which may be raised or lowered at the will of the pilot. Without the wing flap, this plane lands at seventy miles an hour and requires a huge field with the flap, it lands at fifty-five miles an bour and may be

stopped in one third the distance.

The most popular transport of three to five years ago had a top speed of about 145 miles an hour and a cruising speed of about 120. Under favorable conditions it could climb, fully loaded, to about 16,000 feet, and fly 500 miles without refueling This plane has a top speed of 215 miles per hour and a cruising speed of 195, it operates most efficiently at altitudes of 12,000 to \$4,000 feet, and has a range of 1,500 mues

And in this tremendous speed and range lies the secret of the plane's success in bringing the air lines out of the red. It car-

At the ma menance must gleres a expect member a goes over the ship, check ng all working parts. At the left in shown the new iong autenna which chininales static interference caused by raid and dour

> ries a larger pay load and thes over fifty percent more miles in the same number of bours in the air. This is an important facfor, since pilots' pay, maintenance, depreciation, and other charges are based on number of hours in the air-

> It is a thirsty brute. It burns ninety gailons of gasoline every hour, one and a half per minute, against the old transport a sixty -but that is approximately the same fuel macage for a much larger load

> Our plane soon will be equipped with another of the new safeguards, the ice remover. Ice is one of the airliner's biggest dangera. Under certain weather conditions, ice may quickly form on the propeller blades, causing vibration sufficient to lear loose a motor, or may form on the leading edges of the wings, destroying the lifting characteristics while adding to the weight. Ice is blamed for some of aviation's outstanding disasters

> The ice remover consists of soft rubber sheathing to cover the propellers and a rubber covering for the leading edges of the

> > wings and tail surface. If ice begins to form, the pilot turns a switch and the principle that operates the wiper on your automobile windshield is pressed into service to keep the rubber pulsing and to crick the ice, which is then blown away by the shipstream

> > In addition to all the weather information gathered before the start, the pilot regularly receives more by radio-If the weather shows any change the pilot is called and advised. In fact he is doubly advised, for the Department of Commerce is broadcasting the weather along the whole airway at short intervals.

> > This ship is constantly in touch with the ground. It is called every (wenty minutes on a set schedule. It is time for a report. The pilot hands us an extra set of

"Calling Williams in 312" says a voice. "Go abead

The pilot plucks his transmitter microphone from its place and speaks into it.

"Williams to 312, Wilhams in 312, flying 14,000 feet over Harrisburg over clouds."

The airport repeats the message as it is typed for record, and then signs (Continued on page 109)

Lined up on the field, these huge planes have the graceful poise of birds.





In a dramatic test of the U.S. Army's measury-ray detector for hostile ships, the device trained a coarchitekt on the Coast Guard cutter Fontchartrain, managements for offshore in the darkness, as depicted above by our artist

Mystery Ray Locates "Enemy"

U. S. ARMY TESTS DETECTOR FOR HOSTILE SHIPS AND PLANES



ARMED SENTRIES barred visitors from approaching within 200 yards of the Nave sink Lighthouse Station on the New Jersey coast, a few nights ago. Behind the enforced barricade, U. S. Army experimenters were trying

out a secret new weapon invented by the Signal Curps for use against possible invaders—a "mystery-ray" device reputedly capable of locating an enemy vessel as far as fifty mucs at sea

Twenty times the ray detector trained a hage mobile searchtight upon an invisible target - the Coast Guard rutter Pontchartrain, maneuvering without lights somewhere in the darkness off shore. Once, when the beam was lit, it grazed the yessels stem The other maetren times, it struck the Powichartrain squarely amidships, to score perfect bullseyes! Had the detector been used to direct the fire of the big coast defense guns at Sandy Hook, as it would do in war, the ship would have been at their mercy Declaring the test a complete success, the experimenters prepared to try out the devector next for spotting hostile aircraft another of its reported capabilities.

How the mysterious ray de-

Portable transmitting unit of the German utits short wave neiding poment for detecting enemy attends. Diagram shows how plane reflects the radio beam. At right, come up viewed the deminutive transmitting unit



Latest-type antiasceraft "enr " Soundproof abselding eliminates states in sounds, so the instrument can work undesturbed in a gale

tector works is the Army's secret. The merest hint as to its nature is taboo, under stringent new regulations cloaking projects of vital importance

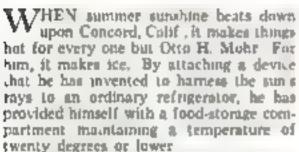
to national defense. Whether it resembles a radio amplane detector recently reported under development in Germany thereforc, is open to speculation. The German apparatus is said to make use of the fact that ultrashort radio waves behave like light tays and are reflected by solid objects. When a curtain of parallel radio beams is propected skyward and receivers are suitably arranged, any plane intercepting the beams will reflect them buck to earth and betray its position.

In this country, meanwhile the "mechanical ears" used in listening for aircraft have been improved. Soundproofing shields the latest type detector from exterior hoises, so that it can work undisturbed and city noises or in a howling gain.

SUN'S HEAT OPERATES REFRIGERATOR



Orta H. Mohr aventur of the su ar refrigerator, with apherica, longer of various sizes



A small box shaped 'solar unit' designed by Mohr provides heat that oper ares the ne-making apporatus, much as a gas flame makes like in a gas-operated refrigerator. A apherical lens in the unit collects the sun's rays like a burning glass, operating at constant efficiency regardless of the position of the sun. How the rays, concentrated upon a reservoir of ammonia water, make like in explained in the accompanying diagram. Two hours' daily exposure to the sun is reported sufficient for preserving food for a household.

Larger sour units have been designed





Saint unit for a refergerator built into the side of a bouge Same costs stimms eraportable

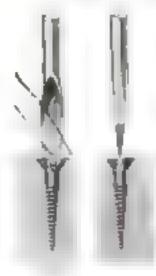
by Mohr for air-conditioning an entire house at negligible expense. In winter, oil heated by the sum's rays is used to warm air, which is then circulated through the rooms by means of registers. In summer, the air is cooled, instead, by applying the principle of the solor ice box.



BICYCLE TAIL LIGHT HAS ITS OWN BATTERY

As electrone tail light for bleycles, just placed on the market, is entirely self-contained. One standard flash-light cell-provides current, which is turned on or off by a thumb switch located conveniently for operation while riding. Mounted on the rear mudguard, the lamp shows a red light to overtaking vehicles, while decorative side lenses display red and green lights respectively in imitation of the navigaling lights of ships and airplanes.

SCREW DRIVER LOCKS IN SLOT OF SCREW



NOS SKID ACTOMA have been devised to end the narrance of a slipning screw driver. Their undercut slots lock the enlarged tip of the special screw driver used to topert them. or shown in the right-hand drawing The acrew driver is inserted or removed edgewise through the end of the slut, us shown at left.



CROOKED SHIFT LEVER SPARES RIDERS' KNEES

More room for the occupants of a car's front seat is provided by a gooseneck gear-shift lever of new design. A bend in the shaft prevents the lever from humping the knees of passengers, while keeping the handle within easy reach of the driver, It can replace an ordinary lever

STREAMLINE BOAT HITS HIGH SPEED

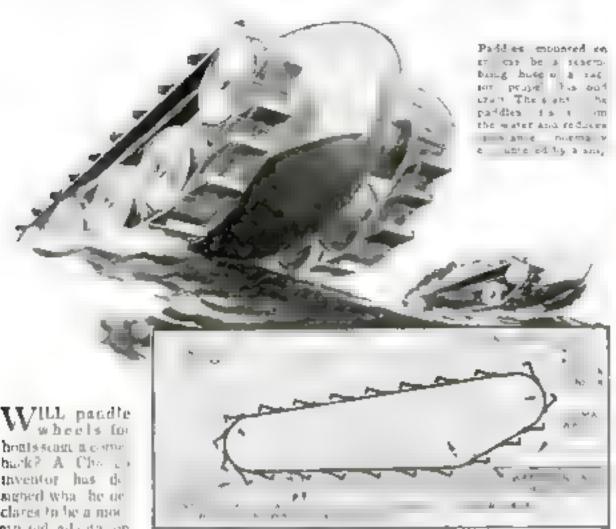
COMPLETELY enclosed in a streamline shell, a racing craft created by two California builders represents a new departure in speed-boat design. Powered by an auto-

mobile motor the new boat skims the surface of the water at high speed, as shown below using a hydroplane step of standard design. It is made entirely of plywood



Streamline speed best in action. Note its resemblance to the fuselage of a cabin plane

Odd Tractor Boat Skims Water



houls scare a come bank? A Charles inventor has deaighed what he declares to be a mosermized adapta ion of the bistoric

form of marine propulsion. His plan calls for a boat that runs upon a pair of endless tracks, after the fashion of a land tractor, the tracks consisting of muving belts carrying a series of paddles. When power is applied to the belts through driving drums near the stern, they cause the paudles to sweep backward through the water impelling the boat forward. At the same time, the planing action of the inclined paddles tends to lift the boat clear of the water with the result that the hull skims

the surface with a minimum of regutance In consequence the inventor maintains a tractor boat of this type could a tain high speed and could travel with a marked economy of fuel. The angle of inclina innof the paddles would be suited a the weight of the craft; a beavy boat would have them mounted at an angle approximating forty-five degrees, while a lighter craft, requiring less lifting force, could employ more steeply inclined puddles to obtain greater forward traction.



CAMERA FOR NIGHT USE HAS LIGHT-BEAM FINDER

A camera with a built-in flash light has been devised for making night photographs. When a button is pressed, the lamp lights up the sucroundings and shows just how much of a scene will be included in the picture, dispensing with the use of a view finder. The original model was developed to aid the coroner of a micwestern city in making photographs at the scene of a suspected crime, but additional applications are foreseen in both amateur and professtonal photography

LIGHTNING BLAMED FOR MOST CURRENT FAILURES

THREE out of four interruptions in electric service are caused by lightning, according to engineers who are seeking to reduce the figure by developing new protective devoces for transmission lines.



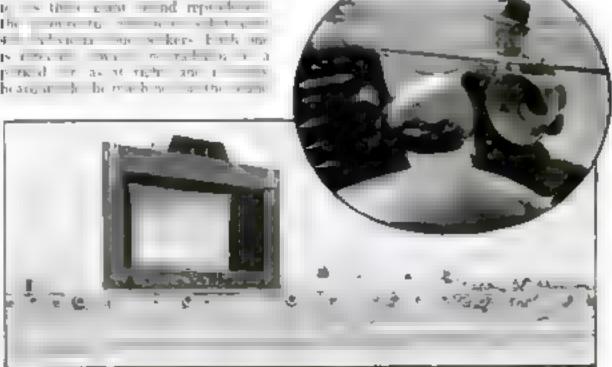
GIANT HOMEMADE WATCH IS JEWELER'S EXHIBIT

MARING his own parts, a Columbus Ohio, jeweler magnified a pocket watch a thousandfold to instruct his customers in the intricacy and delicacy of their timepieces. The giant watch, said to be the argest of its kind in the world took five years to make, is built of metal, weighs 300 pounds and may be driven either by hand or by a motor. A window in the face makes the works visible for purposes of display and instruction.

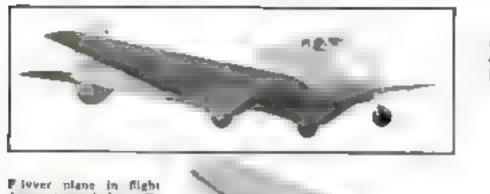
AUTO THEATER HAS 460 LOUDSPEAKERS

Sixce the opening of the first "drive-in" theater, where motorists could enjoy talk ing movies without leaving their care (P. S. M., Aug., '33, p. 19), the idea has spread to several parts of the country, and innovations have followed. When residents per one of hese and Lan Acge a to a suppose of the news to with a gunt and repeated the serve to a serve to a 4 There are no keep both my Primary War to Tale to a little of the latest terms of the latest procedure as at right and a second hearing to be much he is the york

does not carry to an appreciable distance. The ten-acre theater is said to employ the world's largest screen, measuring forly by forty feet, shown in the background of the photograph reproduced below.



FLIVVER AIRPLANE DRIVES AS EASILY AS AN AUTOMOBILE



Fiveer plane in flight during train before offiduring train before officials of the Department of Commerce At the right in a lop view of the a result, showing the landing gear which makes a impossible to note over when landing A "root.root" furver plane, first of fifteen similar ctaff ordered by the U.S. Department of Commerce in its effort to develop types stated for private flying, recently underwent trials before Government officials. According to the designer, Dean

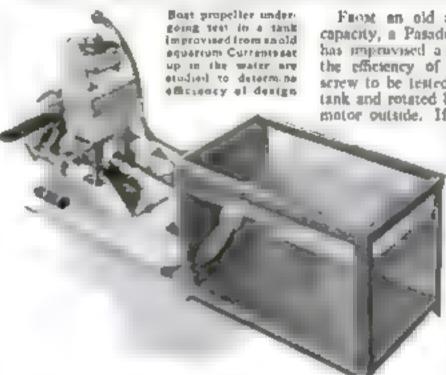
B. Hammond, it can be flown by anyone who can drive a car Landing, principal bugaboo of a beginning pilot, is made easy. Merely holding back the control stick brings the craft graity and safety to earth from any altitude, and a novel arrangement of landing wheels prevents any chance of nosing over



CHAIR-CAR SEATS HAVE LUGGAGE COMPARTMENTS

KEEPING luggage handy yet out of the way, is made easy for chair-car travelers on the Canadian National Retiracys. Each of the revolving chairs is now provided with a compartment at the bottom, just large enough to accommodate one suit case, which a porter is shown stowing away in the illustration above.

TEST BOAT PROPELLERS IN AQUARIUM



Front an old aquarium of one-gation capacity, a Pasadena, Calif., boat builder has improvised a testing tank to try out the efficiency of acrew propellers. The screw to be tested is mounted within the tank and rotated by a gasoline or electric motor outside. If the design is efficient

the propeller forces the war rearward in a smooth spiral but if the propeller is not correctly pitched, it will churn up the water. Poor propellers are also detected because they slow up the motor. Results of the tests have been applied by the builder in model power boats driven by gasoring motors, and in fudsite motor boats.

SPEEDING CAR REPLACES WIND TUNNEL



New pesicine for airplane wangs may be tried out at a fraction of the cost of wind tunnel experiments, according to an Inglewood, Cauf., inventor with a test car that he has devised. The wing section is mounted upon a platform attached to a standard automotile, as shown at left, and tubes lead from various points on its surface to gauges enabling the pressure or suction on different parts to be recorded while the car is dreven at a constant speed. The device recalls a substitute for wind-tunnel tests, developed in France, in which the model under test is attached to an electrically driven rail car for observations of its behavior in a flow of air.



COMPACT SCALE WEIGHS LETTERS AND PARCELS

HANDY for weighing letters and small parcels, a new vest-pocket scale shows at a glance the postage required. When the device is held by a finger ring and a letter is clipped on, as shown above, a pointer shows the weight in fractions of ounces. A table on the counterbalance plate shows the postage rates.

HORN BUTTON HAS CLOCK MOUNTED IN ITS CASE

A combination hard butten and timepiece for automobiles has been introduced by a Mami Beach, Fla., inventor. When the rim of the clock is pressed down, the horn is sounded. The inventor has also designed models with built-in vanity cases, for women motorists. In one of his designs, the winding stem is mounted at the rear, and the clock is wound by rusting and revolving it. It is then replaced in the case on the steering wheel.





The steet in auto-horn buttone -- decorative clock and a combination clock and vanity case

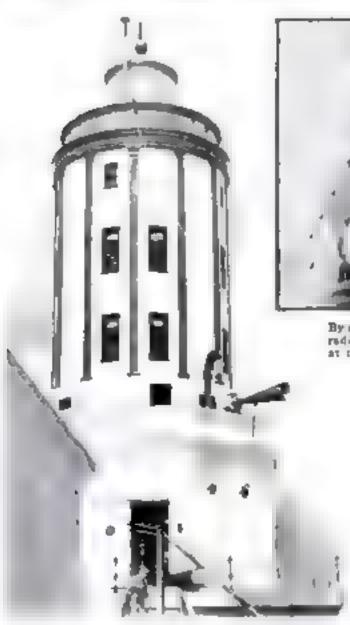


SMOKE TRAIL AIDS SAIL DESIGNERS

To stroy the way that breezes propel a sailboat, experimenters recently fitted a small craft with apparatus that releases a stream of smoke. The course of wind corrects around the sails is made visible by the smoke and pictures are taken with

a move comera while the boot is under way. Improved types of rig for racing craft are expected to result from the studies. The picture above, taken during an experimental run, shows a photographer of the stern making movies of the smoke.

NEW FOG BEACONS USE TWO-TONED HORNS



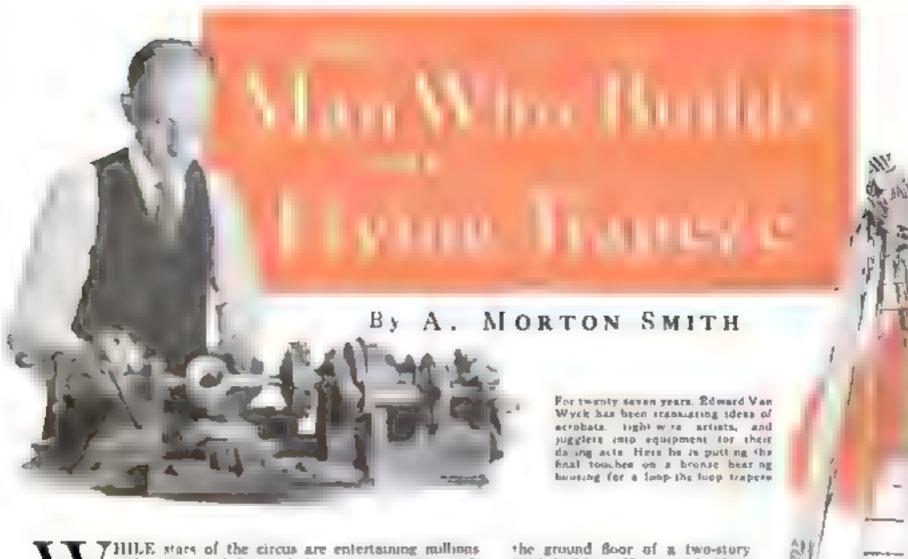
By counting the clapsed time between the receipt of a radio flash and a sound signal from due, home shown at the left, the officer calculates the ship a position

ALTERNATULY emitting a high-pitched scream and a low-toned boom, two-tone foghorus being erected at danger points along the Pacific coast will aid mariners to find their position. Radio flashes are transmitted simultaneously with the sound signals. By listening with a headset for the radio signal and counting the seconds until the arrival of the slower sound wave, a navigating officer can calculate his distance from a heacon. The two-toned signal is used in an effort to eliminate "dead spots" where fogborus of earlier, single-toned types have been found to be inaudible.



HANDLEBARS ADAPT WHEEL TO ANYBODY

A moveue designed by an Italian inventor has reversible handlebars. Riders of less than average height would use the handlebars in their conventional position, while a tall rider would reverse them for comfort. Changing the position of the handlebars occasionally during a long trip minimizes fatigue.



with pensational feats of during on awaying perch poies, high wires, and the flying trapeze, a softspoken, middle-aged man sits at a work bench in his Uny shup in Concornati, Obso, fushioning rigging on which these acrobats and aerialists wil. perform even more breath-taking and dare-dev scarper next season

He is Edward Van Wyck, formerly a professional piggier While he does not make all of the paraphernalia used by circusartists, he is the only man in America who devotes his time exclusively to the manufacture of circus rugging, at times he em-

ploys an many or six assistants.

Years ago, Ed Mislette, an acrealist, had an idea for what he anticipated would be a sessational act. He would stand on his head on a wooden globe mounted on a high trapese. The globe would revolve as the trapese socated in the opposite direction.

creating an illusion of remarkable balancing skill. Fe low performers discouraged him. They said his idea was

n pipe dream. But M lette had trooped with Eddie Van Wyck, who, he recalled, made all of his own juggling equipment. So he went to Cincinnati, looked up Van Wyck, and explained his idea. "Give me two weeks to work it out," Van Wyck said. He tacked the job in his back-yard shop. Two weeks later, the equipment was finished and bune in a Cincinnati theater for a tryout. Millette was delighted, and took his novel rigging to New York where he juined the "greatest show on earth." Has head-balancing act on the aerial globe was an outstanding feature of the circus season of 1905.

For twenty-seven years, Van Wyck has been working out just such farfetched ideas for circus and vaudeville acrobats, aerialists, hight-wire artists, and juggters. He moved his shop from his back yard to a down-town building, because circus folk came to his home and awakened him at all hours of the night to consult him about new props.

There is nothing osteotatious about Van Wyck's shop. It occupies a room. twenty-three by twenty-eight feet on

brick building. His name in black letters on the glass panel of the front door is the only identification. There is no machinery peculsar to his trade, except scures of molds for casting metal pieces used

in rigging, which be has designed and constructed by hand as needed. Otherwise, he uses standard lathes, drill presses, and

power saws.

Not all of his customers come to his ship to discuss their plans with him. Often they write or telegraph or cable from such far-away cities as Muscow, Bombey, Capetown, or San Francisco.

When a circus performer wants a new piece of equipment and its use is explained in detail to Van Wyck, he sketches it on paper

to arrive at the proper dimensions and to determine the materials to be used He has 6 000 sketches of every conceivable type of rigging filed alphabetically by the names of the troupes or individuals for whom they have been made. If he gets a rush order for replacement of some piece of equipment his fires afford him a quick reference for details.

"There are two things about the construction of circus properties that must aiwaya be borne in mind," Van Wyck told me. "One is that equipment must be built of the lightest possible materials without sacrificing strength and durabil-Av The other is that most ngging must be constructed in sections or to fold so that it can be dismantled and packed in small property boxes."

When Van Wyck has completed a sketch of a piece of equipment, he makes a second drawing, this time with crayon on the floor of his shop, reproducing the rigging full size. By this process, any impractical details not discernible on the paper sketch are revealed and he can check the dimensions and compare the equipment he is building with the floor sketch as be proceeds with his work.

"For instance," he said, "I once re-ceived an order from a well-known vandeville comedian for a Japanese footjuggling harrel six feet high. These har-



Con Collegno, the night wire wigerd, does his breathtaking stones on rigging specially built by Van Wyck



rels are usually thirty inches high. But the actor conceived the tiles that a large barre, juggled up his feet would be a good nove ty. I drew the barrel to scale on paper and then sketched t with crayon on the fluor. I discovered its circumference in the renter would be so great that I would not be able to move it through the Goor of the shop when I had completed it'

I decided to bond it in the hallway adjacent to the shop, but at the same time I wrote to the actor and suggested that he draw a full-size sketch of the barrel just as I had done using the demensions I has prepared. I had the harrel about half done when I received a telegram from him to reduce the height from EX to five feet. It had not occurred to how until he saw the smensions drawn to scale, just how immense and unwells to a harrel would have been."

Construction of a foot-juggling barrel involves a process that reverses the customary processore in barrel making. The hoops are placed inside instead of outside the barrel. There are fiftyfive basswood staves, held together with 650 tiny nails. The barrel is covered inside and out with canvas, glaed to the surface to reduce the hazard of breakage. The completed barrel weight only one third as much as an ordinary barrel of the some size

Scarcely a week passes without Van Wyck being called upon to make some piece of equipment entirely different from any-

In this small Cinclenati workshop, Van Wyck turns out his unusual equipment. The rigging on the floor will play its part in a circus theritar by supporting two women hanging by their teeth. Note the full-size sketch drawn on the foor

thing he has made before. A German cannon-ball juggler broke a steel ball, made for him in the Krupp munitions works, soon after arriving in New York for an American tour. So he go hered up the pieces, shipped them to Vian Wyck, and instructed him to dupocate the bail.

Before the cannon ball had been completed, Van Wyck received a telegram from Hollywood asking him to make six sets of tiny wooden sheet for a troupe of dancing monkeys appearing in a motion picture. And a few days later it man brought a trained dog to the shop and explained that he wanted a small-

metal cup in which the dog could put its four feet, the base to be heavy enough that the canine might maintain its balance in such a position.

Al. of these are commonpiace tasks for the circus technic an liker there are intricate problems that chaelenge his inventive genius and mechanical ingenuity Circuses frequently devise something new in nervicinggame-and expect him to provide it

It was Van Wyck who designed the loop-the-loop trapeze, now a feature of many circuses. An ordinary trapeze bar is attached to the supporting crane bar with rigid, steel-tubing uprights as substitutes for rupe. The joints are made with double ball bearings in brass housings. The performer stands on the trapeze bar, swings backward and forward to obtain enough momenturn to revolve swiftly around the crane bar, and the result is a thrilling aerial spectacle

Once a circus girl, learning to propel and control the revolutions of a loop-the-loop trapeze, fell from the top of the tent and was killed. Her feet had slipped from the bar and her hands had lost their grip. So Van Wyck set about to provide a safety device against such accidents. The result was a pair of keys to be attacked to the soles of the performer's shoes. When he mounts the trapese, the keys slip into slots in the trapeze bar and lock so that there is little possibility of a fall.

The safety of circus performers has been as much Van Wyck's concern as the making of intricate equipment on which the dare-devils risk their lives. He introduced the use of steel tubing for the framework and uprights of borizontal bars, flying-return rigging, highdiving towers, and various other paraphernalia, replacing the more cumbersome (Continued on page 114)

fa is also about

Ferry Is World's Largest Streamline Vessel



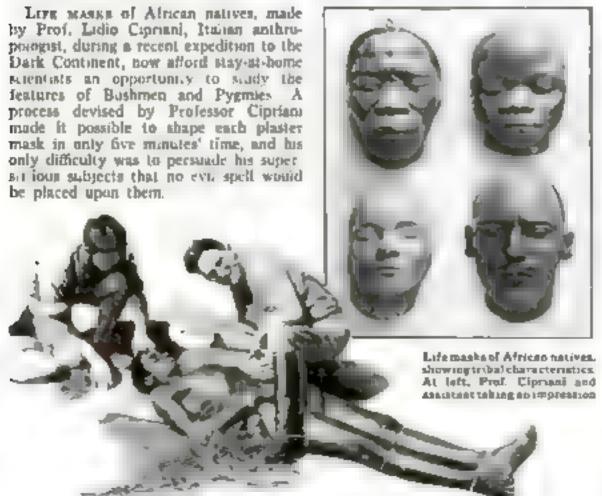
The motor ferry Kalakala recently put into service to carry pessengers and automobiles across Puget Sound.

Declared to be the world's largest fully streamline vessel, the speedy motor ferry Katakala recently went into service to carry passen-gers and vehicles between Seattle and Bremerton, Wash. A welded shell of steel with rounded contours, designed to mansm ze wind resistance, gives the craft a striking outline. Its bridge resembles the wings of an airplane, and the shel. lapers down to the water level at the stern, giving the boat a profile like that of a streamline automobile. The 3,000horsepower vessel meanures 276 feet in length with 55%-root beam, and can carry 2,000 passengers and 110 cars. Its eighteen-knot speed enables it to cross Puget Sound in Jorly-five minutes. The name of the ferry is an Indian word meating "flying bird.



GASKETS of a new type are said to give a tight seal with a fraction of the bolt pressure ordinarily required. Ridges on the surface of the gasket form a crisscross pattern which, berause of the reduced contact area. is more easily indented than the usual flat surface. The gaskets are available in metals and metalified asbestos,

MAKES MASKS OF AFRICAN NATIVES

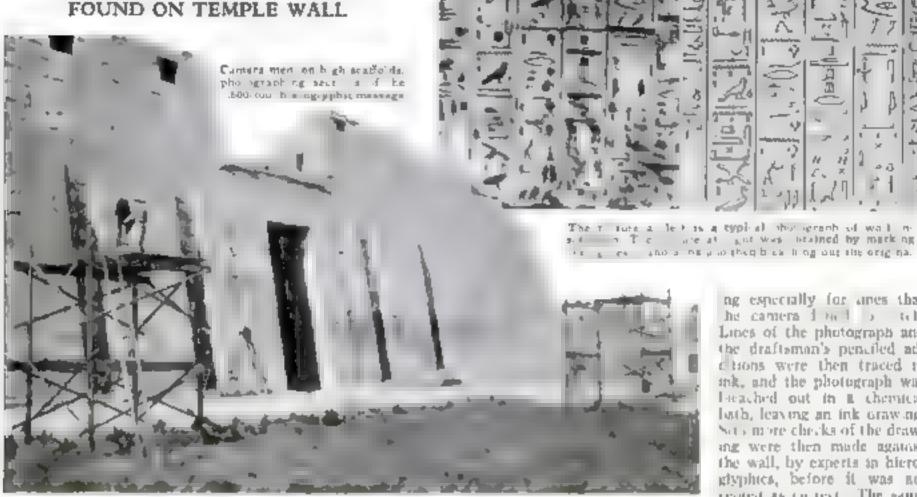




TEST FIREPROOF GASOLINE FOR USE IN AIRPLANES

SEEKING a pure dry-cleaning fluid, a New York chemist stumbled by accident upon a process that makes ordinary gasolme virtually preproof. The result of his discovery, demonstrated recently at New York University, is a reddish jellylike fuel for aircraft that may remove the hazard of accidental fire, authough it can be employed in a motor with marked efficiency. To use it, heat from the airplane exhaust is applied to the fuel champer and the resulting vapor is conveyed to the cylinders. The solid fuel, which can be made from ordinary gasoline in one hour, can be stored without evaporation or risk of explosion In recent tests, it failed to ignite even when incrediary bullets were fired through cans containing the jelly.

CAMERAS HELP EXPERTS DECIPHER ANCIENT FGYPTIAN MESSAGE FOUND ON TEMPLE WALL



RECORDING and decephering a measage in closely packed Egyptian hieroglyphics, covering the entire aide of a temple wall nearly a third of a mile long, is the manumental task just completed by experts of the University of Chicago's Oriental Institute after ten years of work. The 1,600-foot "billboard" at Thebes, on the Nice was used by Rameses III, ruler of Egypt in the twelfth century B C to advertise his prowers in war. Its translation is declared to yield a mass of new know edge about one of the most glamorous periods in Egypt an history.

To preserve the fast-disintegrating in-

scriptions, the experts developed a techmague new to archaeological science. First they divided the wall, for convenience, into a series of rectangles. From lofty perches on wooden scaffolding, camera men then photographed each rectangle. The resulting pictures were enlarged on waterproof paper, capable of receiving a drawing in India ink

Fastering one of these photographs to a drawing board, a draftsman mounted a ladder or was hoested in a swinging seat to the corresponding section. Scanning the wall minutely, be added everything that he could see to the photograph, look-

ng especially for anea that he camera I not o tell Lines of the photograph and the draftsman's penciled adchions were then traced in ink, and the photograph was beached out in a chemica bath, leaving an ink grawing Note more checks of the drawing were then made against the wall, by experts in hieroglyphics, before it was nerepred as correct. The same painstaking technique was

carried out for each section, despite the handicaps of the hot climate.

Translated, the records describe Rameses' exploits in four multury campaigns, and his combata with wild sea rovers, whose invasion of the Nile delta region marks the entry of European peoples on the stage of recorded history. One relief depicts the world's first naval battle on salt water, in 1194 B. C. In another conflict, Ramesea exputing that he caused 12,000 of the enemy to be slain "for a re-membrance of Egypt." Three bugs folio volumes of plates picturing the inscriptions have already been published.



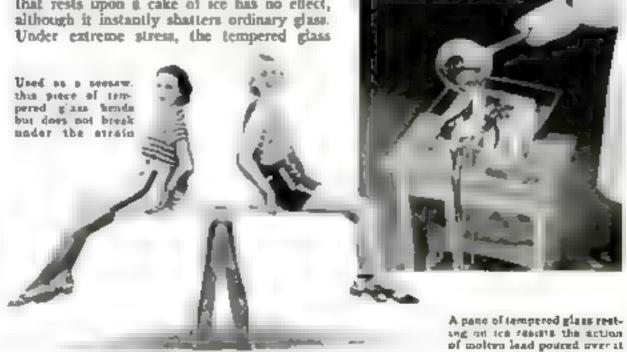
AUTO DEVICE SAFEGUARDS MOTOR AND BATTERY

SKOULD & car's oil supply fail, a simple new attachment automatically shuts of the motor and prevents costly damage to bearings and cylinders. The device also makes it impossible for a motorist to leave the ignition turned on when the motor is not running. It consists of an electric switch in the ignition circuit, operated by the flexible diaphragm of a chamber connected to the oil line. Proper oil pressure keeps the switch closed but if the pressure drops, the switch opens the ignition circuit and stops the motor. A hand control on the dashboard holds the switch closed in starting the car. The device is also suited to use on stationary engines.

NEW GLASS MEETS SPECTACULAR TESTS

Spectacular tests have been devised by a Toledo, Ohio, glass works to demonstrate the resustance of its new tempered glass to heat and abuse. Papes of the glass are bent, twisted, and pounded with a mallet, without breaking. Molten lead poured over a sheet of the grass that rests upon a cake of ice has no effect, although it instantly shatters ordinary glass. Under extreme stress, the tempered glass

merely crumbles into harmless particles like rock candy due to a special process of casebardening. (P.S.M., Nov., '34, p. 18).





Is the Planet JUPITER Our Solar System's



When the supplier to a minimum and a minimum

R family of nme planets (Mercury, Venus, Earth, Mars, Jupi ter, Saturn, Uranus, Neptune, and Pluto) lives in the gigantic house of the solar system—with the sum as a central heating plant.

And, just as the warmth of an earthsy apartment varies when the janutor clokes up the furnace, or fulls to do so, so the heat sent out by the solar furnace varies. This variation in temperature has long been suspected because, in certain years, corresponding seasons were much warmer or colder on the average than in others. It has been only recently however, that the sports and lags of the sun's temperature have been accurately measured.

The instrument which keeps tabs on the sun-furnace a heat output is called a pyrhenometer or sun-heat measurer, and was invented by Dr C G. Abbott of the Smithsonian Institution in Washington, D C

The records which this instrument keeps of the variation in solar warmth (about three percent) reveal that the hottest perioda occur about every ten to eleven years, and coincide roughly with the periods of greatest sun-spot activity. Since sun spots are enormous whiring storms which tear stopendous tents in the sun's surface we may infer that the territic boiling activity of the sun's interior during the period of sun-spot maximum accounts for the greater heat output at these times.

but what causes the increased inner activity about every eleven years? Why are the solar fires self-contained for a part of the eleven-year cycle, only to break out on the sun's surface, periodically in a heat rash of sun-spot storms? The answer to this question may have been furnished by a most ingenious theory proposed recently by Edward Godfrey

engineer and astronomer who lays the

responsibility for the ups and downs in the temperature of the solar family's apartment to one of the tenants. In fact be accused the largest tenant of all, the planet Juniter, with

HOW FRICTION HEATS THE SUN

The effect produced by Jupiter's distortion of the sun can be demonstrated by rolling a spenge-rubber ball having a thermometer in tested as shown in the timestration. The temperature rises after a few minutes of rolling

A simple experiment with a sponge-rubber ball and a thermometer demonstrates a new theory to account for unusually hot summers occurring regularly

By GAYLORD JOHNSON

being the fickie "furnace man" who regulates the heat output

Jupiter, according to Godfrey, has taken it upon himself as the largest and strongest of the sour family, to stoke and control the sun's fires for the comfort, and sometimes discomfort, of all the other worlds in the system. He pokes the solar fires by merely going a few steps toward the furnace room! He has a system of re-



TIDES OF FIRE

Jupiter's powerful attraction raises enormous tides upon the surface of the sun. The rotating sun works against this 'life! 'brake" and thus creaves tremendous friction within its Seep mass. It is these appearing forces that internally the sun a heat-producting activity



AN EXPERIMENT IN DISTORTION

A suft are up to contact half, do contact he will be a first surject of process of the surfect o

Furnace Man?

mote control, which operates through the mutual attraction of gravitation between himself and Old Soi.

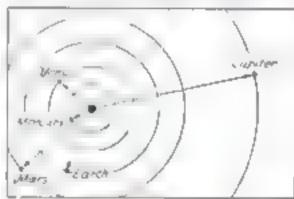
This is how it works. Even though they are separated by an average distance of 483,300,000 maes, both Jupiter and the sun raise considerable tides upon each other's surfaces. Just as there are two constant daily tigal waves following the moon around our earth's oceans, an there are two tidal waves which follow Jupiter across the sun's oceans of liquid fire. (P. S. M., April, '34 p. 50)

Accordingly, during the rotation of the sun on its axis, which takes about twenty-six days, there is constantly a bulge of the surface toward Jupiter, and another in the direction away from the planet. And the sides of the sour globe are proportionately flattened. As you can see from the diagram, the effect is a perpetual distortion of the incandescent ba-

Thu distortion can be roughly imitated by holding a small, soft rubber ball tightly between two books and revolving the ball between the books. As the parallel books travel alternately back and forth the two flattenings of the ball, rotating between them, travel completely around the yielding sphere of rubber. The friction of the rubber molecules upon each other greates considerable heat. It is easy

When the smaller planets are on the same a de of the ears with Jup ser they reenforce the gravity pu' and the production of color heat rises





When the smal or planets are opposed to Jupiter they part ally neutralize that pignet a effect and the creation of polar heat is less

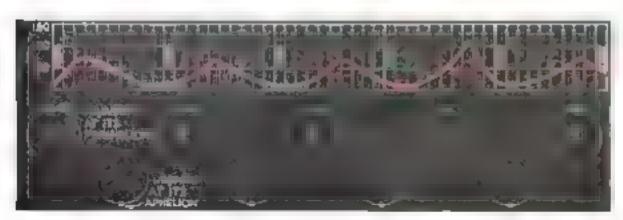
to demonstrate, with an ordinary thermometer, the heat produced by this rolling action

After you have done this, as I did you will realize that a similar moving distortion of the sun's sphere, by the enormous gravitational forces produced by Jupiter is bound to produce heat by the resulting fraction of the sun's molecules upon each other.

becure a solid sponge-rubber ball about three inches in diameter. With a drill or an ice pick, bore a hole through the spongy substance of the ball, atraight to its tenter. Then remove the glass thermometer bulb and tube from any small, inexpensive thermometer. It is held to its scale only by two bittle bent strips of metal. When the glass is free, force it, bulb foremost, into the bole in the rubber ball. Try to have the quicksilver-filled bulb as near as possible to the ball's center.

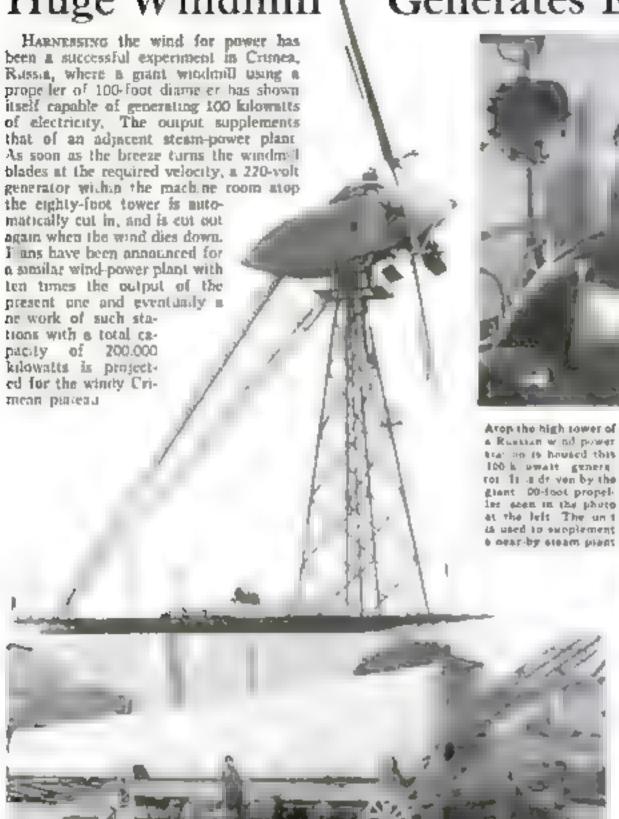
Now you are ready to apply Jupiter's distorting gravitational forces to the plastic ball which represents the sun. To do this, put as much pressure as you can upon the ball's opposite sides with the books, or, better still, two bits of board. And as you press, rotate the ball between the boards. It is easier to apply the requisite pressure if you use only one small board in both hands and roll the ball upon a table top. A little care enables you to avoid breaking off the protruding thermometer tube.

It is, of course, necessary to mark in some way the original height of the mercury in the thermometer tube which projects from the ball is order to measure the rise in temperature. A good way is to tie a white thread tightly around the tube and slip it up (Continued on page 105)



The record of the fluctuations of the sun's heat (measured by the number of sun spots) over temperar intervals orientees with the veristions in the distance between jupiter and the sun. The periods of peak heat production occurred when jupiter was ar a point measure the sun and the revenue condition prevaled when jupiter was most distant—an explanation for but and cold summents

Huge Windmill \ Generates Electric Power

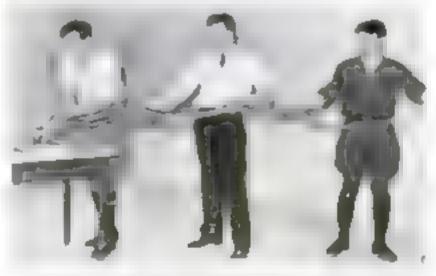


The grout size of the propular, 100 feet across, may be gauged by this close-up of one blade

COBRA VENOM USED IN SERUM TESTS

With the recent discovery that the deadly venom of the colors has hitherto unsuspected medicinal properties a supply

is now being obtained for trai in New York hospitals. The photograph at the right shows a giant king cobra at he Staten Island, N. Y. zoo, heing forced to yield in poison for the experimentent. made thus far indicate that a serum made from the snake venom has beneficial effects when administered to sufferers from parcotic addiction. The experiments have also shown that the venors has a I m ted therapeutic value in the treatment of a certain form of cancer which had been induced clinically in rats by inoculation during the laboratory tests.



A large king cobra, at the States Island Zoo, is made to yield a quantity of its deadly venom for use to experimental serum studies

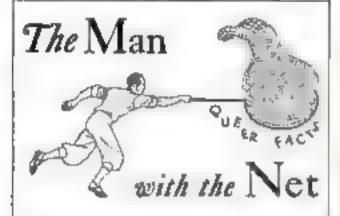
ECHOES LOCATE FISH

Echo sounders, used on thipboard to record ocean depth, may also prove valuable in locating schools of fish. In ordinary depth-finding, sound waves are directed at the ocean bottom which reflects them back to the ship. The time interval before their cetura shows the depth. A Norwegian survey vessel noting to interference in recent sounding work discovered the sound waves were reflected from the backs of a huge school of cod-

NOVEL SIDELESS GOLF BAG CAN BE WHEELED ABOUT



To ato in carrying hat own clubs about a course, a fourteen-year-old gulfer of Brighton, N.Y., has designed a lightweight gulf bag devoid of aides and equipped with a ball-bearing wheel. Easily trundled about, the bag may also be set upright upon a retractable steel spike. A hox attached to the light wooden framework carries five balls, which are released by pushing aside a spring clip, as shown above. Places are also provided for pencil tees, and other incidentals.



INK made from mushroams is being used to fell forgers. If a signature is suspected, the ink is examined for mushroom spores. If it contoins none, the signature is known to be aparious.

DENVER COLO. has an official elevation of one mile, to the foot, above see level.

SEA HORSES, like hangarous, carry their young in panches.



BEES with what is said to be the highest hire in the world live on a terrace of Rackefetter Center, eleven stories above Fifth Avenue, in New York City.

YOUR CHANCE of being hilled in an untumobile accident this year is one in 3,500, of being injured one to 100.

COCONUT SHELLS filled with explosives were used as bombs in a Hawarian revalu-



AVERAGE DISTANCE between meplane landing fields in the United States in thirteen and a half miles.

D'SCARDED automobile broke drams form the chimes of the First Beptist Church in Addition, N. Y

ONIONS give of cays which are reported to be beneficial in treating musal cutarry,

STARFISH have an eye at the end of each arm which can detect light too faint for the human eye to see



A MODERN LINER presents on area of as much as three acres to side winds.

PETR FIED TREES containing gold ombedded in their tranks have been found in Nepoda.

SIX MILLION GERMS have been found on a single house fly by microscopic examination.

LEMONADE was a favority drink in China 700 years ago.



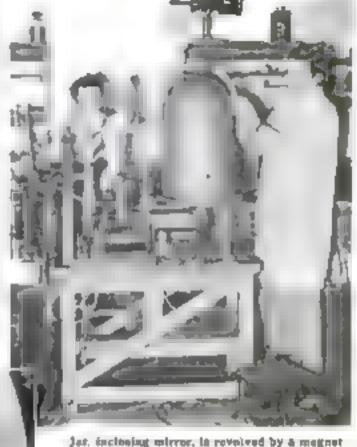
TELESCOPE MIRRORS SHAPED QUICKLY

GREAT telescope merrors may soon be shaped to the required curvature in minutes or hours, instead of years, through a newly announced metalbring process. In the traditional method, the glass mirror must be ground to an exact parabolic curve

-an operation of such delicary that it took three men five years to gried the 100-inch mirror of the Mt. Wilson Observatory in California—before the sittering or the newer-style reflecting coating of aluminum is applied. The latest process, successfully tried out on a twelve-rach disk, the other day, at Pasadena, California and builds up the desired curvature out of the finishing coat of aluminum itself. If anything goes wrong, it is necessary only to remove the aluminum and repeat the process. The



Breas screen with operate which distributes aluminum. And he superionental glass disk



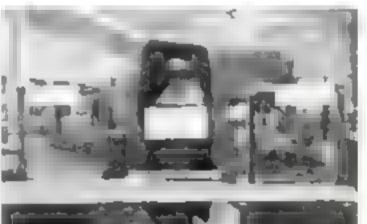
aluminum, evaporated from heated electrodes, is deposited on the glass in a vacuum par. While the curror in its mounting is slowly revolved, by a U-shaped electromagnet outside the jar a brass screen with an opening of question-mark shape distributes the aluminum in the exact mathematical proportion to produce the paraholic curve. Micrors of hyperbolic and other complex shapes, almost impossible to grand, may be prepared by the new process.

FILMS INCUBATION OF A TURTLE EGG

What goes on made a tortle eigt, before a furtle hatches, has been filmed at the American Museum of Natural History to produce a movie of unique scientific inter-

est. By fitting a small window in the side of an egg and arranging a mirror to project a magnified, eight-inch image of the contents. Dr G & Nobic curator, obtained

inctures of the bying turtle embryo in all its stages. De velopment of the eyes and other organs, and even the heart beats. were clearly viscine in the fire ished film, which is expected to - ove of exceptional interest to underta of buology The experiment was made possible by the fact that turble eggs incubate at approxima ely the temperature of the average room. obviating the need of keeping them in a special (ocuba er which would have made motionpicture photography difficult

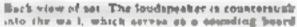




A extended with a stranged term of the extended ter

WALL RADIO SET GIVES IMPROVED TONE







SEEKS INVISIBLE FISH WITH BLACK LIGHT

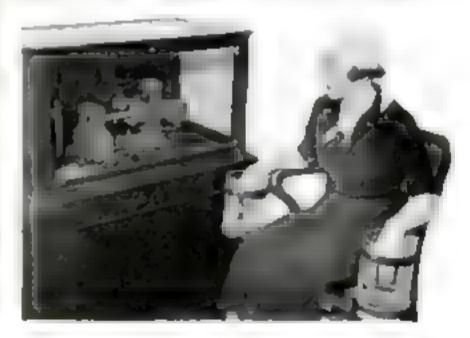
Do "INVISIALE" FISH, colored in hues beyond the range of the spectrum visible to human eyes, inhabit the lightless depths of the ocean 2,000 feet or more below the surface? To find out. Dr. Wit iam Beebe noted explorer, plans to take with him an ultra-violet-ray projector on his next descent in the diving globe that he has used in deep-seat explorations off Bermuda Shown above, the projector will direct a beam of "black light" through a quarta porthole, causing responsive marine ife that comes within his range to glow or fluoresce brill antly

MACHINE REVEALS HEART AS DYNAMO

MINUTE electric currents, generated in the buman body by the beating of the heart are made visible by an electrocardiograph recently placed on public exhibition

at the Franklin Institute, Philadelphia, Pa. Wares lead from the apparatus to a pair of cups, attached to the arms of a chair and containing an electrically conductive solu tion of brine. When the hands are dipped in these cups, as illustrated at right, contact it made with the regustering apparatus, yard the visitor may see the feeble heart currents amplified and made visible in the form of a pulsing shadow up a tube

which forms part of the machine. The study of such currents, within recent years has proved of incalculable value in medical diagnosis of many cardiac disorders.

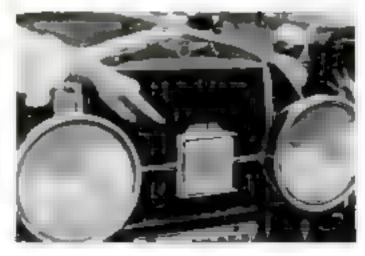




avoiding undestrable back pressure

BITS BORE DEEP WELLS

Despite their distorted appearance, but of the odd shapes shown above are used to hore straight hotes, serving to sink wells more than two miles deep. The bits range from three and three fourths inches to twenty-eight inches in diameter, and from thirty-two to 2,200 pounds in weight. The larger of the bits illustrated is used to start a deep hole, while the smaller one chops through rock 1,200 feet below the surface.



CAR GIVES WARNING WITH MUSICAL TONE

A new electric warning signal for automobiles, designed as a substitute for raucous horns, employs metal chimes. When the steering-wheel button is depressed a powerful magnet actuates a hammer that strikes a pair of tone hars at the top and bottom of the housing producing a inclodious and plainly audible signal. The compact size of the new signal is shown in the photograph at the left.

Splicing Tool Aids in Study of Hairs and Fibers

FIGHTING gangsters and maketeers may be the unforeseen application of a tiny instrument perfected by a U.S. Department of Agriculture technologist. Because he wanted to study hairs and fibers from a commercial viewpoint, Dr J. I. Hardy devised an improved tool to slice them into thin transverse sections for microscopic exammation. Through its use, a specimen can be prepared in ten minutes, instead of several hours required by former methods. Moreover, the structural details of each fiber are preserved so clearly that identification is easy, not only is it possible to dis-Linguish at a glance between batr wool fur, silk, or cotton, but a particular type of each may be recognized.

Department of Justice officals point out that a scientific detective, armed with the new method, might make rapid and valuable use of so small a clue as a fragment of hoir found on a suspect a clothing or at the scene of a crime. A tuft of clothing fibers, such as a burglar might leave behind on a half or splinter might be compared with a suspect's exements and prove his presence at the place. In the field of commercial frauds, the lovention provides a check on racketeers misrepresenting the quality and value of furs

By means of a screw-controlled place of the three-inch instrument ejects a of fibers, in perfect abgroment, from only eighty-five ten-thousandths of an inch



MODEL STATION ACTUALLY BROADCASTS

OPERATING on less power than it taken to run an automobile tail light, the world's smallest broadcasting station, nicknamed "WEE." has been placed on exhibit on by a rathe manufacturer. A six-inch working model of a stand microphone, in a minu-

ture studio, may be used as a hand type and is put in operation by throwing a second of the second o

a sea to e



The world's smallest broadcasting station, which operates with a transmitting range of 200 feet



USE NOVEL OBSERVATORY TO STUDY LIGHTNING

To study lightning, General Electric engineers have just erected the unique observatory shown in the upper view above. A periscope topped by a crystal ball enables an observer to watch flushes in all parts of the sky without turning his head. Meanwhile, a twelve-lens camera, shown in the lower view, photographs the strokes. A continuous blast of compressed air from a ring of perforated pipe keeps rain away from the lenses during a storm.

Microscopic

OFFER RARE BEAUTIES TO



SIMPLESPECIMEN WASHER
'Place' sigas may be washed in
a charactoth-present transler A
flow of water in supplied through
a glass tube excending to the bot
tont of the glass. At the left are
apprograss, magnified 100 1-mee

Photomicrograph of diames magnified about 475 times a little of the green deposit off the

EVERAL weeks ago, I bought a bird both, an earthenware affair colored dark green. There was a sunny corner near the hiy pool that seemed to have been created for it. The basin of the bath is emptied every day, ringed out, and filled with fresh water. One day I noticed that, instead of the usual dark green, the basin was lighter.

in rolor where the water stood, as if some one had sprayed a thin conting of light green paint over it. Or was the original color fading? Each day the green became brighter.

Close examination revealed that the paint had not done a chameleon act, but that the bottom of the basin was covered with a slappery, brilliant green scium. What was it? The naked eye could not discern. Here was a chance for that new microscope objective lens to prove its worth.

It required but a minute to scrape a little of the green deposit off the

tasin with a knife, transfer it with a medicine dropper to a one- by three-inch glass slide, and drop over it a No. 2 cover glass (twenty-two millimeters square)

algae stand our more distinctly under the microscope. Here a drug is being placed on the cover glass prior to mounting

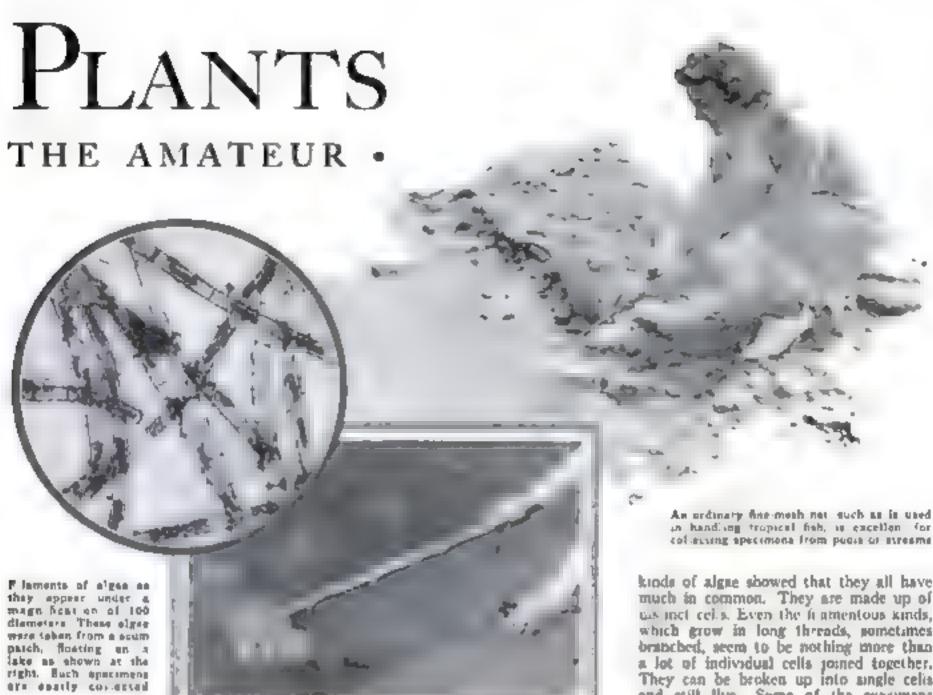
A bit of adjusting at low transmittent on and there appeared in the microscope field a shapeless mase of green material. After I had looked at it for a minute or so, it began to take some semblance of form. Here and there could be distinguished masses of little green balls. So I switched to a higher power, 575 diameters to be exact. Surprising what a tenfold increase in magnification will do.

The green bads were very distinct now. Some were clustered in little groups of four. Here and there were pairs of them, flattened along the lines of contact. Scattered about were single, round ones. In addition to the balls were assorted filaments, but of shapeless tissue and one or two microscopic animals acurrying about among the green plants.

A textbook of botany soon cleared up the mystery. The green balts were what the botanist calls Pleurocorcus enlgaris a non-moving form of one-celled, green algae. The little groups of two, four, and more were formed by divisions of single rells to produce new lodividual piants, a common method of reproduction. Pleurococci can be found on stones, shady sides of old tree trunks, flowerpots, and the earth itself. Masses of the tiny cells have the appearance of splotches of green paint

If, in that bird bath, there was growing such a brautiful, though simple, incroscopic plant, what about the thousands of other algae to be found all over the

Endless Varieties of Algae, Always Within
Easy Reach of Every One, Become Fascinating Subjects Under the Microscope's Lens
By Morton C. Walling



world? The botany book had said that there are some 9,000 or 10,000 known. species of these tiny plants, to say noth-ing of the ones that baven't been identsfied. They grow wherever there is enough moisture and light to permit them to manufacture food-in ponds, lakes, rivera, ditchea, stagnant pools, awamps, on moist rocks, even in hot springs!

So an expedition in search of such fairylike plants, whose beauties can be seen only through the nucroscope, seemed in order. An empty petroleum-jelly jar with screw lid, a few two-ounce bottles with wide mouths and cork stoppers, a foot long piece of glass tubing, and a small net of the type sold for handling tropical fish in home aquariums, comprised the

collecting outfit.

A short drive brought the field expedition to a small creek gurging along a rucky hed. Flanking the main channel were relatively still pools of water, in some of which were patches of bright green, even more brilliant than the one in the bird-bath basin. The water was four or five inches deep, but with the aid of the glass tubing it was a simple matter to gather some of the green material without stirring up a lot of mud. The glass was used first to loosen the green growth which turned out to be mostly Spirogyra, one of the commonest and most besutiful algal forms-and then as a dipping tube to raise the material to the surface and deposit it in a bottle, half filled with water. The use of the dioping

tube was described in last month's issue

The fish net, made of cloth similar to window-curiain material, proved to be a serviceable took for gathering small, freefloating masses of algae, and even for capturing individual cells, inscrescopic in size. The net would have been better however, if an opening had been made in the bottom and a small, glass phial inserted and beld by a rubber band. With such an arrangement commonly used by collectors. the collected material is washed from the net into the phial, by swishing the net through the water. You will be surprised at the things you capture in this way in addition to alene

After collecting some mud from the bottom of the puddles at the edge of the creek, the expedition moved on. More creeks; roudside ditches; a tropical-fish batchery where masses of algae were growing in the breeding tanks-all yielded additional material. Floating in a small take were masses of harlike strands. held up by imprisoned bubbles. A bit of one of these was pulled in with a stick

But it was at the microscope that the real exploring began. This experience proved even more thrilling than the field expedition. Under the mant of the lensex, the acummy masses in the bottles became fairyland plants, whose beauty must be seen to be appreciated. It was a simple matter to mount bits of the algae on a siide with water as a medium.

Examination of the several different

much in common. They are made up of us incl cel's. Even the framentous kinds, which grow in long threads, sometimes branched, seem to be nothing more than a lot of individual cells joined together. They can be broken up into single cells and still live. Some of the specimens were seen to consist of threads made up of live green cells and dead empty cells haphasardly strung together. The dead cells probably were emptted by microscopic animals which believe in vegetaman dieta.

The grown-up algal cell, which is a perfect example of a plant cell, is incased in a membrane, made usually of cellulose. Next within the membrane in the protoplasm containing various objects such as vacuoles and chromatophores or color-containing bodies. In the

center is the cell nucleus.

The chromatophores of some cells contribute more than any other part to the beauty of the plant. They may be shaped like plates, stars, spirals, strings of beads, or disks. Some are arranged in regular order others like microscopic nets and still others with seemingly no attempt at order. In some forms of algae are dense bodies lying within the chromatophores. These are called pyrenoids and have been found to contain albumen and to be surrounded by starch. They apparently are storehouses of reserve material.

If you know your Greek, the "thromate" part of the word chromatophore will suggest that that part of the nigal cell contains color. This fact is easily verified with the microscope. The color however, is not always green. There is a large family known as the blue-green algae. Such colors as brown, red, purplish green, and yellow are common.

Rocklike deposits around some of the hot springs in Yellowstone Park owe their pink, blue, blue-green, orange-red, and yenow colors (Continued on page 94)

Handy Aids for the HOMEMAKER



ORINDER REPLACES CARBAGE CAN Driven by an electric mater the device constraint above requests waste foods to a fine pulp which washes down the draw without abstracting a Everything from watermeion i nd to soup bones can be obtained or material and the unity succeptions being bots in and the cans. Greaters and to conguests and pass through without clogging

STAND SUPPORTS BLECTRIC PAN

Resembling after temp, the electric fan ar the right can be placed in any part of the team. The stand is adjustable from thirty are to are ty five tuches to beight



A set of glass food into that a rde around in an oval tray, is the latest refrigerator convenience With a touch of her finger the housewife rauses (he jees to move making the selection of food quick and aimpir



ORATER TAKES COUN FROM COS With a new k reham accessory the task of removing given corn from the cub a made easy. The ast of curp to held to the position above by dutted not the panels panels points to the ridged grains blades.



INCENSE STICKS ARE STRUCK LIKE MATCHES Intended for destroying undestrable adors in the home. In the type of incense stick to ignited the a match by rubbing the head on a rough surface. While burning it may be light in the hand or propped in a basic in the best as I furtrated. Various scenes, such as violet, are available.



SANITARY MILE BOTTLE TOP RESEMBLES A BATHING CAP

Slipped over the month of any milk bortle, a new rubber bood provides an antitight cover and protects the lip of the bottle from dort Frensing of the mrk does not break the weal, but merely pushes the cinete bood upward. After the bortly has been partially empired the bood can be replaced to protect the remaining milk. Intended for use by duries, the covers can be produced cheaply



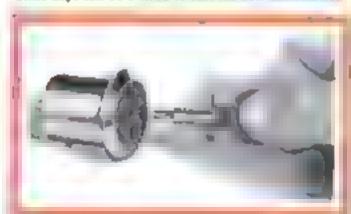


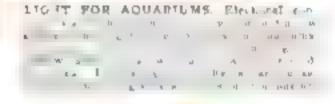


FOR APPLIANCES

Pursons who habiton by full enlarp coading can be assured that the lights will be turned off at any hour specified, by the use of a new spectral time control. This device will also turn the radio on or off automatically or it can be used to control other electrical appliances for any colerval up to Iwanty four hours.

PROTECTION AGAINST LOST KEYS I! a home owner loses one of the keys to the new sek shown below. he can forcests! the use of the key by an unaction sed person. Pins and tumblers in the took can be tearranged so that the four key will not fit and the other keys can be a tered to suit the new combination.







Greater solety for the baby as provided by a sofety purchast of open Ani gh pressure tooks the point inside the quart Topphoto abors shows provided to wer photo p n ocked At selt, the pin in use



MIDGET SEWING MACHINE Weighing only about five and a half pounds the glocing new-the machine disastered above is convenient for travelers and in, has more or college women. It amps a say table and a said to do almost anything that a machine of aundard acce will do



"LIPSTICK" SUEDE BRUSH Smaller than a lipstick, this handy wire break pleases suede shoes and also removes dirt from bats, handbags, and gloves. A metal cap covers the break when it is not in use, to protect the handbag or pocket



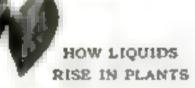
small parcels, as well as letters are accommodated by the mail how. The letter compartment tills leewerd to make a rack for them

WONDERS OF

Plant Life

SHOWN BY

Simple Experiments



The upward enovement of water or asp in a plant can be shown by fitting an eye dropper tube to the end of a cutturg by means of a short piece of rubber tubing. Do this under water so the dropper will be filled. Place the tip of the dropper in a vial of water. The water level in the vial will go down as the figurd is drawn upward into the plant



Place a fresh leaf between two pieces of glass and clemp with spring clothes pins. In an hour or two, one of the pieces of glass will be coated with moisture given off by the atomata, or breathing holes. These atomata are located on the underside of each leaf



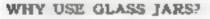
and a

OSMOTIC PRESSURE IN PLANTS

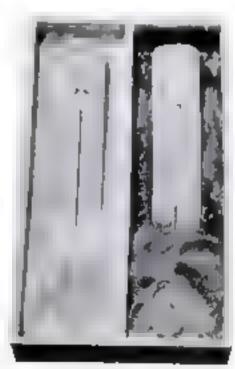
To demonstrate the force which raises the sep in a plant, fill a hollowed out carrot with sugar solution and fit it with a glass tube. As the carrot takes up water from a jar, the solution will be forced up the tube



How all plants turn toward the hight may be shown by sowing mustard seeds in a pot and covering it with a cardboard cap in which a small win dow has been dut Remove the cap each day and examine the plants to see how they seek the light



In growing roses and other plants from slips, an inverted glass jar is used to keep the plant warm. Its value is shown by placing a thermometer in a jar and another outside. The one made shows a higher temperature when the sun is shining on both



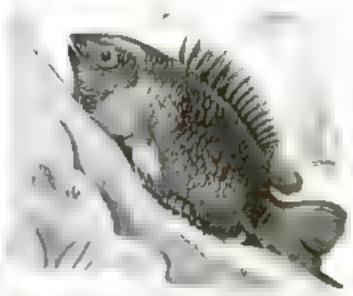
DARK SOILS ARE WARMER

A dark soil absorbs sunlight and therefore is warmer than a light soil. In the experiment, one thermometer is covered with white sand, the other with sand and charcoal

Un-Natural History Gus MAGER



THE SURINAM TOAD (DUTCH GUIRNA AND OTHER AMERICAN TROPICS) SOLVES THE HOUSING PROBLEM!
THIS CURIOUS CREATURE IS A LIVING APARTMENT HOUSE! ITS PROGENY HATCH, AND ARE REARED, IN SINGLE ROOMS, OR CELLS, ON THE FEMALES BACK



MERE IS AN ASTOUNDING FISH, THE
CLIMBING PERCH (ASIA) THAT
CLIMBS STEEP STREAM BANKS, AND
WALKS OVER DRY LAND, PROVING THE
DLD SAYING OF AFISH OUT OF WATER*
15 THE GUNK



GIG ROBBER CRAB

(ISLANDS OF THE INDIAN
AND PACIFIC OCEANS)
BREATHES DRY AIR, IT
CLIMBS COCD PALMS
AND BREAKS OFF THE
NUTS WHICH IT OPENS
FOR FOOD WITH ITS
CREAT CLAWS



THE
ELECTRIC EEL
IS POSITIVELY,
SHOCKING!



THE MANATEE - THE STRANGE MAMMAL
THAT GAVE RISE TO THE MERMAID LEGEND
AMONG THE ANCIENTS, PROPABLY FROM
ITS HUMANLIKE HARIT OF ELEVATING HEAD
AND SHOULDERS ABOVE THE WATER SURFACE!



PIPE THE MARINE LZAK WALTON, THE ANGLER FISH, FLOURISHING AN HONEST-TO-GOODNESS ROD AND LURE, TO CATCH HIS DINNER!

SOME of the strange frenks of nature leave one as puzzled as the cross-even k d at a sex-ring circus. That's why we have named this page "I n-Nat ral History." It depicts some apprently dizzy and out-of-order facts in the realm of a rad has ry. Freaks like these circus are one wonder who her the laws of na are are near properly experced.

HOME EXPERIMENTS EXPLAIN

Mysteries of Household Products

> MPRESSED by an array of test tubes and flasks, the family and friends of an experimenter who has set up a home labcontory are inclined to regard him as an expect in every con-ceivable branch of chemistry. They ply him with all sorts of practical questions. What kind of cleaning preparation will take out a certain stain? What will unclog a stopped-up drainpipe? What makes paint dry?

> Solving all the problems that are trustingly put up to an amateur chemist might take years of study. Here are a few experiments with familiar household preparations, however, that will help supply some of the answers. Knowing how a commercial compound works, you can often prepare one that will do the job as well and at less expense.

> One household stand-by you have worked with before is sodium hydroxide, or causes soda, sold as lye at hardware, drug, and grocery stores. Years ago, housewives used it to make soap, by treating fatty substances with a solution of lye. You, yourself, may have made Castile soap from lye solution and olive al., as described in a previous article in this magazine.

> An important homehold use of lye today—removing obstructions from clogged drampipes—depends upon a similar chemical action. Drain stoppages are caused by greate, which is insoluble in water and which retards flow by reducing the inner diameter of the pipe. When a strong solution of the is poured down the pipe, it reacts with the grease and turns the latter into a soluble soap. which is easily washed away

> Another alkali on your laboratory shelf-potassium hydroxide. or caustic potash—also reacts with greate to make soap. Would this chemical be as effective as lye for clearing a drumpipe? Try it, and you will find it works even better. The resulting "potassium soap" is more soluble than the "sodium soap" that lye forms. Lye is med in most commercial drampipe cleaners, simply because it

> Several new preparations for cleaning drampipes contain inficon or metallic aluminum, besides lye. The lye reacts with the grease to form snap, as before, but it also reacts with the silicon or aluminum and releases hydrogen gas. This gas mechanically agitates the solution and turns the soap into a froth, making the cleansing action more effective. Place some cleaning compaiend of this type in water, in your laboratory, and you can collect the hydrogen gas that is evolved. The reaction between aluminum and a solution of caustic soda offers you a convenient new way of making hydrogen for laboratory experiments.

> Since pipe-cleaning preparations depend upon the action of an alkali, you can see why a cleanser of acid type would be useless for this purpose. However, cleanners using an acid have other uses in the home. Such a one is sodium basulphate, or sodium hydrogen sulphate, which removes stain from thing and porcelain. When the stained surface is moistened, and the chemical is sprinkled on and rubbed vigorously, the stain is removed. Mechanical abrasion plays a part, but the action is principally a chemical one.

> Sodnun bisulphate dissolves in water to form a solution that behaves much like sulphuric acid, as you can readily demonstrate Place some iron nails or wire, and a solution of sodium bisulphate, in a flask that is fitted with a cork carrying a glass tube. The tube should be of rather large diameter—say, three eighths of an inch—



UNICH SHARES PRANT



A drop of linteed oil, which has been treated with a homemade paintdrying compound becames tacky. The other drops, not treated, remain liquid. The drier acts by speeding up anidation of the lineced oil

and measure about five inches long.

Warm the flask, and you will notice that the iron is rapidly attacked. A cleaning preparation of this type is effective because it reacts with iron and other stains that are attacked by acids. Hydrogen is evolved in the process, and you can fil. a test tube with the gas by dropping it over the glass tube. When the tube is closed with the thumb, and opened again with a lighted match beld. to the mouth, the hydrogen-air mixture produces a gentle explosion with a pe-

cultar "plurping" noise

Other cleaners work in different ways. Grease spots are removed from clothing by liquids such as carbon tetrachloride or gasoline; these dissolve the grease directly, without effecting any chemical change, You could remove grease from a clogged drampipe with these liquids, but the process would be wasteful because of the amount of solvent required, and dangerous if an inflammable substance were used. Sodiam peroxide and perborate, which remove stains from wood, owe their cleansing ability to their outlining effeet. Oxalic acid has a bleaching action. Many scouring powders employ an abrusive to scratch or wear off the stain, but are fortified with some harmless alkaline agent like sods ash that helps the process by dissolving the discoloration or turning it to a less con-EDICUOUS COLOR

Paint provides an interesting material for home experiments. Must laymen imagine that when pasat dries, the process is merely one of evaporation. It is true that the solvent, or thinnerconsisting largely of turpentine-does evaporate like water. The hardening of the paint, however, has an entirely dif-

THRE

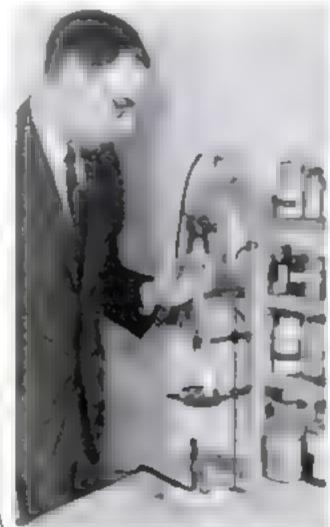
\$ODBJM

ferent cause: It is due to the axidation of linseed of, by the oxygen of the air, under the accelerating influence of a sub- CONDENT NO stance carled a drier

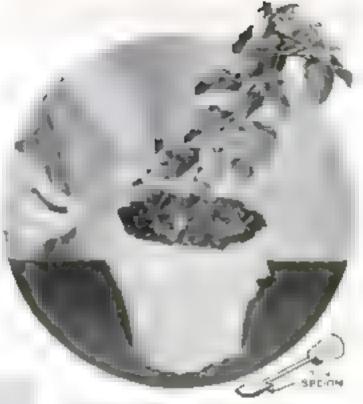
This speeding-up effect. of a drier is easy to show if a drop of linseed oil assureman without it, and another follower containing the drier are left aide by sine over night. The treated oil will harden, white the

In Your Laboratory, You Can Show How the Industrial Chemist Makes Bulliard Balls and Buttons out of Ordinary Skimmed Milk

> By RAYMOND B. WAILES



Hydrogen being lighter than air, can by collected in an invested test tober. The novel method of making the gas in this asperiment without acids or asbalten so constrated at the left



HOMEWADE "FLANT FOOD" & comadmirated letteraing minture, like those manufactured commercially being applied to a potced plant. The tiny apoen used for this purpose is shown in the drawing

other will remain liquid. You can try this test for yourself, since a small attiount of drief is easy to prepare in a home laboratory

Paint-drying compounds usually contain borates or resinates of manganese, cubalt, or other metals. A typical drier is manganese'borate. To prepare it, dusolve in separate portions of water some borax, and a manganese salt such as manganese sulphate or manganese chidride. Mix the two solutions. A precipitate of manganese borate will form, and the flesh-colored substance may be recovered by filtering off the liquid. Pouring water upon the precipitate, while it is still upon the filter paper, will wash away any impurities. The filter paper may then be unfolded and the precipitate dried. Only a small amount of manganese borate need be mixed with linseed oil to make it harden, or become tacky, more quickly than untreated oil

If you try mixing the drier you have prepared with machine oil, you will find it has no effect. Mineral oil does not oxidize in the air to form a tough protective film, as imseed oil and other vegrtable oils do, and hence it cannot be

used in a point

"Plant food" tablets, sold to stimulate the growth of potted plants in the home, need not mystify an amateur chemist. Obviously, what they contain is a fertilizing mixture, and it is easy to compound a similar bomemade preparation that will benefit both house and garden plants. The following formula supplies the potast same), nitrogen, and phosphorous that are considered esscattial for plant growth, sodium antrate, one and one half parts, trisodium phosphate one part; potassium sulphate one part. The term "part" represents any unit of weight, for example, you may use one and a half ounces of sodium outrate, one ounce of trisodium phosphate, and one ounce of potassium sulphate

Powder the chemicals and mix them intimately. A pinch of the maxture, or about half a gram, should be sprinkled on the soil around a potted plant about once every two months. The plant should be watered after the chemicals have been applied. Be careful not to use too much of the mixture. A convenient way to handle it is to place it in a small vial or pitl bottle, and to attach to the cork a little tin spoon, cut from sheet metal, for measuring out the dose of

proper size

The chemical plant food may (Continued on page 110)

Laboratory Stand Made of Metal Towel Bar

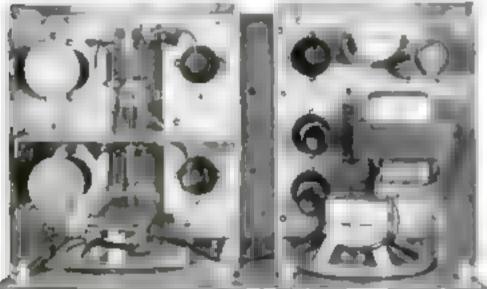
A PERMANENT and convenient support for beakers, flasks, and other laboratory equipment may be made from an all-metal towel bur Que of the ten-cent kind will serve. Straighten one of the curved ends and screw it to the table top. The other end, left curved, is attached to one of the end uprights of the chemical beach. This arfatigement leaves plenty of clearance for tightening the act acrews of rings, burette clamps, and other standard laboratory accessories. Details of construction are shown in drawing at eight.



Build this Receiver with



ERE is your chance to build an all-wave receiver that makes use of the mest thing in rad o paris—all-metal tubes. It we months ago when the development of these "gas-pipe" up is was test announced Popt LAR Science Monthly made special greangements with the manufacturer to obtain an advance selection for use in an all-wave receiver. Various circuits were tried tests were made and accurate logs kept. The result is the careful videsigned six-tube outfit illustrated and described in this ariscle. It is easy and inexpensive to build and gives satisfactory joudspeaker volume up foreign on well as local short-wave stations.



The latest in radio parts and the last word in radio tubes are used in this up-to-date, six-tube, all-wave outfit

By WALTER J. BRONSON

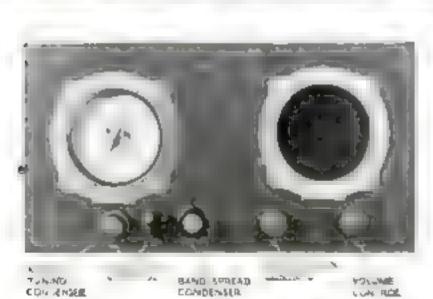
The small size and all-metal design of the new tubes provide valuable constructional advantages over the glass type. They can be stowed away in small corners of a chassis, require no individual shielding, and will stand shocks and abuse that would rum an ordinary tube. Also, since all the new tubes are provided with eight base prongs, of the same size, arranged in the same pattern, one type of socket can be used throughout

After a careful study of the characteristics of the new tubes available, the following types were selected for use in this all-wave circuit: The radio-frequency stage makes use of a 6K7 triple gr. I, supercontrolled amplifier tube. This gives a ratho-frequency stage.

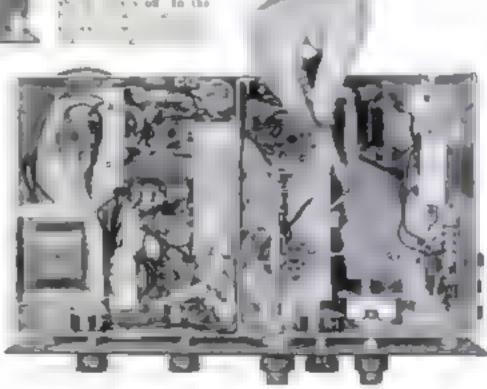
with ampie gain feeding into a 617 tube wind as a well-stabilized regeneral ve detector. To insure guot, tone quality of the audio transfer from the detector stage to the first audio stage a high-impedance plate-coupling choke is used, the grid of the first audio tube being resistance-coupled through a condenser to this audio choke. The first audio tube is a 605 detector-amphiber triode while the second audio stage employs two 6D5 amphiber triodes connected in push-pud. For restriction a 5/4 full-wave received to used

Due to the high degree of sensitivity and selectivity of this receiver, a nucrometer adjustment dial must be employed for tuning and setting the ganged tank condensers (C, and C₂). The rotating ratio of the tuning unit shown is approximately twenty-eight to one, using the small, center knob. A larger knob, mounted on the same shaft, provides a direct drive. Obviously, as with any selective receiver, the best tone quality is obtained only when the receiver can be tuned exactly on a hair one to the desired station. It is all too easy to skip over a station completely if the receiver is not properly equipped with sensitive controls.

The small, three-plate, band-spread condensers (C₁ and C₂) are adjusted by a plane any drive having a ratio of twelve to one on the smaller knob and direct drive on a larger



Disa speaker griffs, and controls on front panel. The handsome cracking finish is easily applied in the home radio workshop.



New Metal Tubes

knob. If the planetary drive used is not equipped with some sort of railbrated that, one must be supplied. In the original receiver shown, a small aluminum dial plate, calibrated in arbitrary units

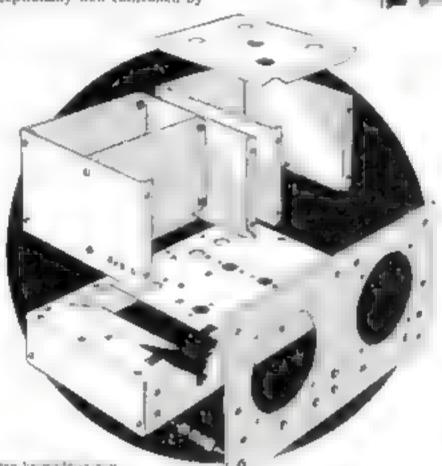
was fastened to the large shaft of the drive.

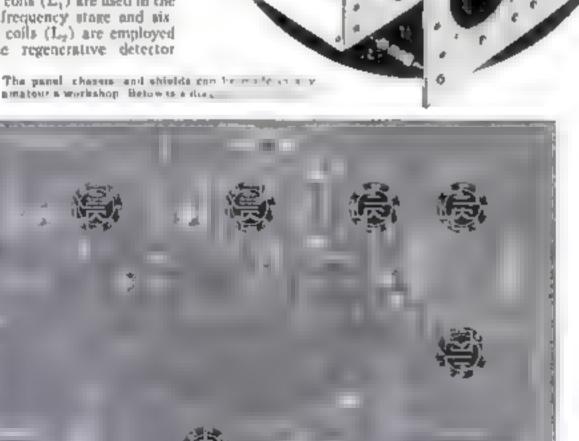
A 10,000-ohm variable resistance (R₁) connected into the has supply of the radio-frequency tube (6k7) to provide sensitivity control is a distinct advantage of the circuit. Mounted on the front panel between the tank tuning knob and the band-spread knob this control serves a dual purpose, since in regulating the sensitivity it also veries the amount of noise picked up by the radio-frequency stage. Thus, in a relatively noisy location, the sensitivity control can be adjusted to a point just above or below the noise level. When this has been done, all stations, local and distant, will be received without local background noise or other disturbances due to man-made conditions.

Regeneration in the circuit is exceptionally well controlled by

the 50 000-ohm ve ume control (R₁). This control is placed fourth from the left on the front panel. To insure noneless operation, the moveable arm on this resistor is by-passed to ground through a one-microfarad noninductive, paper filter condenser. In use, the regenerative and sensitivity controls should be adjusted together so as to obtain equal regeneration over the entire tuning range of the receiver

Experiments with several types of plug-in coils showed that the most favorable results were obtained with commercial coils of the ribbed-form type illustrated. These coils (L₁ and L₂), are well matched to the 140-model. Variable condensers used and are inexpensive. Four-prong coils (L₁) are used in the radio-frequency stage and six prong coils (L₂) are employed in the regenerative detector





stage Six coils in each stage twelve in all, cover the entire

broadcast and shirt, wavelands

Since all metal tubes have the same number of

have prough in the same pattern, a single type of notices can be employed in this circuit

> Atthough the panel chassis and shields look like commerctal products, they can be cut beat to shape, and finished in any amateur's workshop. As the reader will note, the 8 by 15-anch panel cut from oneeighth inch thick sheet maminum is mounted exactly one half inch away from the chasma and shields. This is to provide ventuation as well as ample space for mounting the fourinch tuning dial and the fiveinch dynamic speaker. Halfinch spacers (washess will serve) are used in conjunction with long screws to fasten the complete panel assembly rigidly to both the chassis and the stage

> The black crackle finish on the front panel is easily obtained through the use of a re-

cently developed paint product. This paint is apposed rapidly with a broad and baked on it a gas oven

A 1. by 1° 55-inch rectangle of aluminum serves as material for the 2½ inchdeep chasses. The metal can be bent easily to form a chassis measuring 2½ by 8 by 14½ inches. All four corners of the chassis should be riveted or holted together by means of small aluminum or brass angles. A 2 by 8-inch cut-out on the top face of the chassis, two inches from the left-hand end and bent down to form an angle of thirty degrees, serves as a mounting for the tank condensers. This cut-out can be clearly seen in the photograph of the chassis.

The shields for the radio-frequency and detector stages can be bent to shape from a 6 by 24-inch sheet of aluminum, while the saido stage shield can be bent from a 6 by 23-inch sheet. When completed, the shields should measure 5 by 7 by 8 inches for the detector stage and 5 by 6 by 8 inches for the audio stage. Each should have a one-half inch flange around its bottom edge.

(Continued on page 107)



Makes Neat Holes In Metal Chassis

UNCHES and dies recently placed on the market provide one of the sampiest ways of making neat large-diameter holes in metal chassis for tube socketa, electrolytic condensers, and coils. Because they produce smooth cuts without bending or otherwise marring the surface of the metal, they can be used on completely assembled chasses as well as on the flat stock. In use, a pilot pin in the die fits into a small hore drilled in the chassis and serves to center the punch. A sharp blow with a hammer is all that is necessary to drive the punch home. In the photograph above the punch is being used to make holes in an assembled chassis.

Single Knob Controls All Condensers



Pencil points to small hand-spread condenser. Main tuning condensers are opposite on frame

COMBINING main condensers and band-spread condensers in one unit, the tuning assembly illustrated accomposhes with one knob and one dial what heretofore required the use of several controls. Both band-spread and tank or tuning condensers are mounted on the main frame of the unit and are controlled by a single knob located under a double-pointer that. Pushed in, the control knob turns the main tuning condenser; pulled out, it rotates the band-spreading units.

A PAGE OF NEW IDEAS

For the Radio Fan

Five-Meter Sets Used at Track Meet

AT A high-school track meet held recently in Los Angeles, Calif., five-meter transcrivers constructed by amateurs proved their worth by making it possible for the spectators to hear the resu is of each event immediately after the contest was noished. A portable five-meter ourfit stationed at the fittisb line of each race, flashed the results to another transceiver

located at the control board and microphone for the general public-address system. From there, loudspeakers broadcast



Anadests announce track results received on short-wave transcriver

the information to the spectators, cominating the usual period of suspense and uncertainty,—K. F

Long-Handled Pliers Are Easily Made

AN INEXPENSIVE pair of long-handled phers, useful for retrieving screws or nuts dropped accidently into a receiver

cabinet, can be made from two lengths of bus-bar wire and an ordinary spring clip. Simply solder the two sections of wire to the hand grips on the clamp and your piece are complete. A hird band" such as this as a valuable time saver when it comes to hold rog small parts in place in the depths of crowded chassis while screws are tightened or soldered joints made By using clamps of various sizes, a set of pliers can be made



Wrench Set is Housed In Tool Handle

THIS socket-wrench set provides, all in one tool, almost every size of wrench needed in repairing and building radio receivers. It consists of a nickled-steel bezagonal shaft with a knurled handle and six removable end attachments to fit the shaft. Five of these attachments are socket wrenches, varying in size from three sixteenths to one half inch. The south is a medium-sized screwdriver. When not in use the end attachments stow away nearly in the bollow handle where they are always handy and less likely to be mislaid.

Extension Rod Adjusts Trimmer Condenser

ALTHOUGH the amateur can after the ordinary type of "postage-stamp" padding condenser to make it serve as an antenna trimmer condenser controllable from the front panel of the receiver (P. S. M., Apr. '35, p. 46), such units now can

be purchased ready made Designed for mounting on the misule rear face of the chassis, the screw adjustment on the trimmer condenser is provided with an extension rod. This rod projects through a hole cut in the front face of the chassis and when fitted with

a knob provides a convenient means for adjusting the compression plates of the mice condenser. The extension rod is long enough to fit almost any chassis, and can be cut as required to bring the control knob flush with the panel.



Knob on from panel controls screw adjustment of trimmer condenser



Do parrothish provide food for other fish?

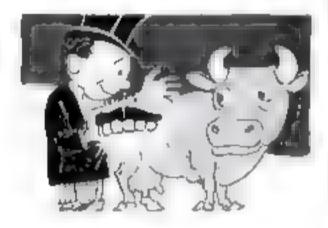
-W. B., Dallas, Tex.



A- THE green-toothed parrotiish upends in the water and gllows numerous small fish, cassed wrasse, to clean its teeth and scales by exting all adhering debris.

But the Chinese Prize It

S. D. B., coversion, RY. The previous idea. that all lade comes from China is erroneous. The great jade mines of the world are in the northeastern part of Burma and along its burder adjacent to Yumnan, China.



Could Use a Set of Uppers

C F., woosnorker, R. t. Cattle have no teeth in the upper jaw to grazing, the vessiation is pulled, rather than cut off, by the lower teeth which press on the tough membrane covering the upper jaw

Isinglass Has Fishy Ancestry

N M J., GREEN BAY, WIS. True hanglass is obtained from the awimming blacklers, or counds, of several species of fish. The finest is aglass is prepared from the sounds of sturpeons which flourish to certain Russian rivers in the Caspian and Black seas, and in the Arctic Ocean, Joinglass is a pure form of gelatin. Mica, often confused with himilam, is a naneral substance

When Leap Year is Skipped

Q.-ARE there any occasions when a leap year is skipped?—D. S., Homestead, Pa.

A.—THERE times in every 400 years, the lesp-year arrangement is omitted. This is nocomplished by not recknning to leap years the years ending in two ciphers, unless they are divisible by 400. Thus the year 1000 was a leap year but 1700, 1800, and 1900 were not. This procedure was adopted to keep the calesdar more nearly in hormony with the solar year. By the year 4000, continuing to use our present calendar, there will be a difference of one day between the two years, calendar and solar

Leaves Are Sun Shy

Q set there any plants on which the leaves grow in an edgewise position?-I., M A., Forest Park, IL

5.- costrant plants, such as the Australian eucalyptus, rosinweeds of the prairies, and peachly cabbage of waste lands, turn their leaves edgewise in order to minimize the drying heat of the mulday sun. The plants turn the flat surfaces of their leaves to the morning and evening star to that the tips of the leaves always point to the north or south, beace their

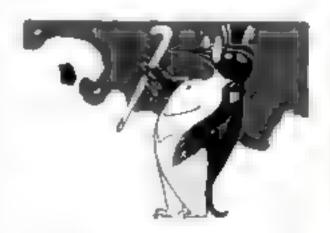
A Colossus Among Clams

Q. WHAT is the largest shellfish extent to-A. M. Shreveport, La

1411, grant anis, Triducini gigas, found about the coral islands in the Par II. Ocean are probably the largest shellfish. Their shells frequently weach 400 pounds. They have a life much estimated to be from sixty to 100 years.

Horseless Horsepower

E. F. FORT WORTH, TEXAS. Of the total installed horsepower in this country, it is estimated that motor vehicles account for eightyfive percent. This estimate places the total at approximately 1,672,000,000 horsepower, of which wast sum about 1,425,000,000 horses power are in the nation's sufomobiles.



Not Even Polar Bears

R. E. B., TERRE HAVIE, 1838. No feet-bearing land animals are found within the Antarctic Circle. Neither are there any true sauves. The only wild life on the lands of this area are penguins and certain sea birds. Some species of insects have been noted by explorers. Whiles and seals, which are marine mammais, constitute the only important animal life of the South Polar regions.

That Big Harvest Moon

Q-wave is it that the moon appears so large when you see it rising from the horizon? - M. B L., Flint, Mich.

A .- 1 HAT the moon appears larger when seen at or near the horizon than when higher in the sky is an optical illusion. When we look to the borizon, our vision takes in many objects on the way and we subconsciously reason that the distance is less than when we look straight up into space. Accordingly, the mind reasons that the moon being nearer to us, it must be much greater in suc in order to have its cormal appearance when high in the heavens. Actually, the moon is about 4,000 males more distant from the observer when at the horizon than when at its sentle.



It's an Old Family Custom

Q.—as tire manner in which animals rise, from feet or hind part first, an andividual trait or is it characteristic of a whole species? - N G. Lau Claire, Wo.

A .- CAMELS, gosta, antelopes, giraffes, sheep, and bovine cattle invariably rise hand part first. Other members of the cudchewing family act simularly. All other large four-footed animals rise on their front less first

O. K., Blame the Indians

D A., PRINGHAR, 10WA. The origin of the term O K is not definitely known. One version of its origin is that it is a corrupt on of the Choctaw Indian word "okeh," menting, "it is so and not otherwise." Another account attributes its origin to General Andrew Jackson who supposed the initials to be those of the phrase, "all correct " Still another ascribes its use first to Jacob Astor, founder of the Astor fortune, who employed the initials if he wished to make a artisfactory repty on an inquiry about a trader's credit

Comet May Chase Its Tail

N. O 5., council supper, towa, The tail of a comet is not formed until the comet comes near the sun and it follows the head of the comet only when the comet is approaching the sun. As the comet moves away from the sun, the tail precedes the head. The sun exercises a strong expelling influence on the surface of the comet. One explanation is that the surface of the sun is negatively charged with electricity and, as a consequence, drives out from the comet those particles which are sim-Barly charged.

Plants With Twining Ways

H L. M., Madagington, n.t. There is no scientific basis for the common notion that twining plants twist around their supports in one direction, clockwise in the Northern Hemisphere and in the opposite direction in the Southern Hemisphere. The direction of twining seems, in most cases, to depend on the plant species and (Continued on page 115)



A Lesson in Careful Driving

T WAS later than usua when Gas Wilson, of the Model Garage, tight-reed the last nut on a rush job and decided to call it a day. The gray-haired veteran mechanic tossed the spanner into the kit attetched to straighten the kinks out of his spane and wasked over to the sink where his partner, for Clark, was already washing up.

Many les coming for that bus first thing in the morning," he grunted Be

sure and tell him-"

Gus a voice was drowned out in the wailing, tearing screech of rubber being dragged over concrete. The noise terminated in a sickening third and the brittle tinkle of shattering glass.

"Cripes!" shouted Gus, tossing the soap into the nink and wiping his hands on his overalls as he rushed for the door. "Somebody a got bumped down at the crossing!"

The two garagemen ran out into the

taut reki

A haddled figure was lying in the middle of the road at the crossing, a few feet in front of a sedan which had stated around and crashed its rear hub against the heavy, concrete base of the traffic light. Behind the wheel of the car a cha ky-faced driver was feebly shaking his hands in a state of almost complete nervous collapse. One of he rear windows of the sedan, on the side toward the traffic post, lacked a large section of glass which had broken outward and crashed into the readway.

Gus and Joe bent over the huddled figure. "It's Rummy Dunkins and he's soused to the eyes" exclaimed Gus, as he caught night of the man's face in the glow

By MARTIN BUNN

of the car's headights and staffed a heavy aroma of alcohol

"Sure! Thash me!" grissed Dunking, suddenly pupping to a sitting position. "Only I am I stewed, not to the eyesh yet, but I will be soon!"

"Where d the car hit you?" Gus asked.
"What car?" countered Dunkitu. "Oh!
You mean that car, there? He didn't hit
me! I wash too quick for him. I fell

Gus dragged Dunkens to his feet and let him stagger off down the road. Then the garageman walked around to the window of the wedge.

"Snap out of it mister Nobody's high?"
he granted to the driver, who was staring pop-eyed at the lurching figure of his imagined victim.

And maybe that isn't a relief!" the car owner gasped as his face regained its normal color. He fumbled for a cigarette in a limp package and lighted it with trembling fingers

"Run the service car down here, Joe," said Gus after a quick inspection of the rear axle of the sedan.

It developed that the owner was on his way to visit relatives in the town, so the garagemen delivered him to his destination after towing his car to the Model Garage.

The next day, just as Gus was finishing the repair work on the sedan by fitting a new bub cap, the owner arrived.

"Good afternoon, Mr. Montrose," Gus greeted bint. "She's just about ready for you." Looks an good as new," Montrose smaled. "Only thing is, I'm wondering if I we got the nerve to tackle driving again I haven't been at it long, as you probably avened, and that affair last night sore took the starch out of me."

"You're less likely to have an accident now than you ever were before," Gos asserted with conviction.

"If I do, it certainly won't be my fault," said Montroie, with equal emphasis.

"I wish Captain Williams of our police force could bear you say that," laughed Gus. "Maybe you don't know that the police departments all over the country are making a drive to cut down the number of auto accidents. They think that when 36,000 people are kaled by cars in one year something has to be done—and they're done it, too. But what they've done so far isn't a patch on what they could do if people would really cooperate."

"How do you mean, 'cooperate'?" Mont-

That's easy to answer," replied Gus. If the average driver would get it into his head that there just weren't going to be any accidents caused by anything he old, that attitude would make a whale of a difference.

M introse laughed, "I never knew anybody started out with the idea that he was

going to get into a crash."

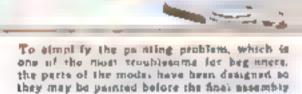
"They don't, directly " Gus explained. "but they do what amounts to the same thing. They are always willing to take a chance. They'd rather trust in Providence and their own good luck than in common sense and careful (Continued on page 112).

THE HOME WORKSHOP

PICTURESQUE

Freighter Model

of Simple Construction



OO little attention is paid, nowadays, to the humble freighter as it goes from port to port and sea to sea, bearing the brunt of the world a commerce while the ocean liner takes all the glory. Surely if romance still exists in commerce, it is typified by these hard-working ships, just as it was represented centuries ago by the caravels that set out to find trade routes and discovered continents instead

We have therefore chosen a typical freight steamer as the October project of the Popular Science Mode of the Month Club. No particular thip has been copied, but the model closely follows the lines of the lamous war-built "Hog

Islanders' that now carry the Stars and Stripes into every known port. These ships are about 400 ft, long and 6 000 tons gross. While the graceful sweep of decks and

Designed
especially for the
POPULAR SCIENCE
MODEL-of-the-MONTH
CLUB

By Theodore Gommi

meging s missing they have a trim and bus misslike appearance

White pine or basswood are best suited for a mock of this size though balsa may

he used and the remaining materials are easily obtained. A complete ist is given at the end of this article.

In order to a low for more octal, the scale—approximately I in equals 30 it.—is larger than that used for previous Model of the Month Club ships, and the freighter has a full hull instead of being merely a water-line model, It is 14 in, long

Begin the construction with the hull. To facilitate the shaping of the counter and stern-post, saw a stot about 234 inling down the center of place A, as shown in the drawings. Lightly nuil A to B, or use two downly without glue, so the parts can be separated fact. Glue C. D and E to B, and her process with the shaping. The cross-section diagrams are included in the plans for guidance, but it is not necessary in a model of this size to make tempor es

Round out the hulf at the stein to the approximate shape of the dotted one shows in the side elevation. Insert the fiber piece F into he so I previously cut into A., the stand of page 10.2)

Side view of the freighter model, which is 14 in in length. The scale is approximately 1 in. equals 30 is.

The base shown is 6 by 10 n and the model is thousted no twinty-side imately 1 in. equals 30 is.



Bowls and Flowerpots

THAT LOOK LIKE MARBLE

FRE is a novel type of handicraft that will appeal to every member of the family. The flower-pots and bowls lituatrated are much more beautiful than they appear to be because the exquisite coloring cannot be reproduced, yet they require no special skill to make and cost next to nothing.

Mother can have just as many flowerpots as she wants, and she can change the
color scheme every month if she desires.
Six-year-old Dorothy can make her own
play dishes by the dosen. Twelve-year-old
Ja.k can earn some extra spending money
by starting a factory at home and selling
artificial marble products to friends and
neighbors. That leaves Dad out, but never
fearl. He will be in it up to his elbows in
no time.

You will see from the accompanying photographs that the articles are cast in forms improvised from bousehold utensils of various sizes and materials. The size and shape of the articles you can produce are limited only by the available utensils and your own ingenuity. Just a few possibilities are pin trays, ash trays, trust bowls, flower bowls, and vases.

Suppose you select a flowerpot for the first piece. The material required is about two cents' worth of Keene's cement and less than one cent's worth of plaster color. Since you will wish to make several things, it is wise to purchase about a quarter a worth of Keene's cement and spend five cents each for four or five plaster colors. Black, blue, red, green, and yellow will

give a good variety. Mortar colors are not as satisfactory as plaster colors,

Keene's cement is a white, finely ground, slow-setting cement often used to plaster bathrooms and kitchens that are to receive an enamel finish. The cement when finally set presents a very hard, smooth surface. It can usually be purchased at building supply firms in any quantity. The plaster colors are dry mineral coloring pigments and may be obtained at the same place as the cement

The form is easy to assemble. Simply use a jelly glass and a teacup that is at least 1/2 in, larger in diameter and rather tall. The one pictured was purchased for five cents in a dime store and is of 33½-in, inside diameter and is 5 ½ in. ½ 1. To complete the form, cut a stop of tin or light galvanized from about 3/2 in. wide and long enough to encircle the top of the cup above the handle with a good tap Hold this collar in place with wire or strong cord. Now set the glass inside the cup and measure to ascertain how high it needs to be to give about 3/2 in, space in the bottom.

The amount of cement needed for the mix is one fourth more than the amount of dry cement required to fill the form.

By
Everett G. Livingston

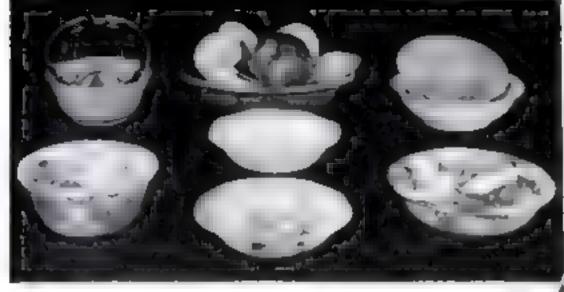
Assistant Professor of Industrial Acts,
Incom. Steele College

The amount of water accord is toghtly more than one third the amount of cement by volume

After the form has been used to determine the amount of cement needed, the cup should be coated on the inside with what is called "dope," and the felly glass should be coated on the outside. The best dope is made by heating paraffin to a liquid state and adding an equal amount of kerosene. The result, when cool, in a paste of about the consistency of pash shoe polish. Lacking the paraffin, you may use any kind of grease that will not discolor the cement too much. The mass should be nearly filled with sand to be d it down in the cement.

The mixing may be done in any clean atensil that is not rusty. A tinned spoon is useful for doing the mixing. When the cement and water have been stirred together to a smooth mass that handles easily but is not sloppy, the colors may be added. There is no need to harry because Keene's cement may be retempered by adding water and cast as long as two hours after the first mixing.

If a solid color is wanted, mix the color thoroughly in all of the batch. Do not use more than ten percent as much color as you have cement. If you wish a marble-ized effect, mix a little of one color into part of the batch and a different color in another part. These colored areas should be stirred together slightly, or they may be mixed when putting the cement in the form to give a marble appearance.



Several finished bowls and the forms in which they were cast. The form for the fruit bow a though not shown, was more y two common vegetable bowls. At right. The flowerpot and its form

Now place the cement in the cup and bump the cup against the table several times to jar out the air bubbles. Set the glass carefully in the center of the cement and press it down to the desired depth. That operation should squeeze the cement up around the glass to the top of the band around the cup. See that the glass is properly centered, wipe off any overflow of cement, and place the cast in a cool, clean place to set,

About twenty-four hours later, you should be able to remove the form. First take off the metal band and pour out the sand. Warming the glass by pouring hot water in it will soften the dope and factitate the removal. The cup also may be warmed by setting it on a radiator or in hot water. Pouring cold water inside the cast will help since it seeps through to the cup. Tapping the cup lightly will sometimes jur it loose.

When the form has been removed, the flowerpot needs to have the rough edges dressed off and the surface improved by sanding. If you can get what is known as "wer or cry" sandpaper, which is water-proof in sizes 4/0 and 5, 0, the sanding operation can best be done under water in a pan or a sink. Lie the courser paper to smooth the edges and level the top,

When removed from its form, the casting is rubbed with waterproof sandpages, used wet

then sand the pot all over with the fine.

The pot should now be allowed to dry until it is just slightly damp before the final polishing with fine sandpaper. It should be dry enough so that the colors do not smear, but not bone-dry. By alternately sanding with word, fine sandpaper and polishing with a dry cloth, you can produce a good luster. A buffing wheel on a motor may be used to advantage in this process. The best results are obtained by sanding and polishing a little each day for several days.

Although these pots are not waterproof plants may be set directly in them. The result is that the pot will always be slightly damp, and occasionally a little roughness will appear on the outside. A few minutes' work with fine sandpaper will put it in shape again, however

Ferbaps you would like to apply some sort of paint or other material to the Keene's cement. In that event it must be bone-dry, which takes a week or ten days.

The dowerpots may be waterproofed by painting them on the inside with liquid rubber, which is expensive, or coating them with aquarium rement; or they may be given several coats of good waterproof variath on the maide. Another possibility is to use a commercial cement paint

Impregnating the pots with paraffin is a still better way. It not only makes them practically waterproof, but also brightens the colors and adds to the luster. Place the pot and the paration in a double boiler and bring them gradually to a temperature that will melt the paration. Roll the pot around in the hot paration for several minutes and then take it out. There will be no apparent coating of paration on the surface. The inside may be given a heavier coal by pouring the pot full of melted paration and then pouring out the remainder after a layer has been deposited by cooling.

Ordinary kitchenware is used

for molds . . . The special

cement and colors cost only

a few cents for each article

If the pots are waterproofed, they may then be treated on the outside to enhance the richness of the colors and the luster of the polish. Several coats of imseed oil produces a pleasing effect, but slightly tints the white. Warm the cement and the haseed oil and apply the oil generously with a cloth or a brush. Allow it to set for about an hour and wipe off any oil that remains on the surface. Repeat the operation in about twenty-four hours, Several apparentions of knaeed oil may need to be applied before the surface seems no longer to take it up readily. A light sanding and polishing between conta helps develop a smooth surface

After the final coat has set at least twenty-four hours, it may be brought to a high laster by the use of paste furniture wax, or a coat of dammar variash or colorless lineleum lacquer may be put un

Bowls and other pieces are made in much the same way as the flowerpot,

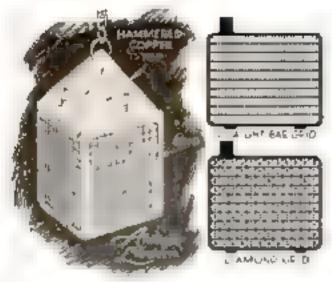
OILCLOTH IMPARTS CANVAS TEXTURE TO PHOTOS

Grossy printing and enlarging papers can be given an actistic canvas texture by squeegeeing them on oilcloth instead of the usual ferrotype plates. This is a valuable expedient for amateur photographers who do most of their work with ordinary glossy papers and do not keep on hand a variety of other papers for occasional artistic prints

Any good grade oilcloth may be used if it is a plain color, has a smooth, even mesh, and is without imperfections. Paste or glue it on a smooth, firm support. A sheet of glass, covered on both sides, provides an ideal surface. Should wood be used, it must be perfectly smooth. Paperhangers' paste or flour and water cooked to the right consistency is a satisfactory adhesive

The or cloth surface needs no treatment to prevent priots from sticking. Merely wipe it with a damp cloth to keep it clean, Prints may be taken directly from the wash water, and will peel off readily when dry. However, the print will are flatter when dry if first soaked for half an hour in a ten percent glycerin solution before it is squeegeed.—Atvix J. Braver,

MODEL FITTINGS FROM BATTERY GRIDS

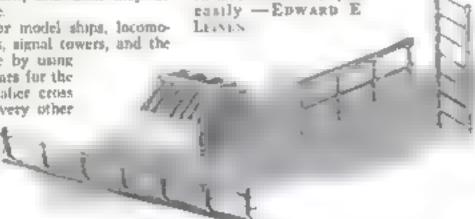


BY PURCHASING new positive lead grids from a local storage-battery repairman, I solved the problem of making small ladders and railings for ship models These grids may be had in either straight or diamond pattern, and both may be used to advantage.

Fine ladders for model ships, locomo-Lives, freight cars, signal towers, and the

ike can be made by using the heavy cross bars for the sides and the smaller cross bars for rungs, every other

Reddings, a ladgraing out from land STREET batte y gr de which are unaful for making many pa to ul mudele



ed and will break quite

CABINET HAS RECESS FOR EVERY TOOL



NLESS every tool in your shop has

you are through working with it, you are

certain to waste much time. There are

many good ways to rack your tools—wall

panels, open shelves, and buzes—but cab-

inets are among the best because they give

The size of the cabinet will naturally be made according to your own supply of

tools or specific needs. It should be of

strong lumber, and sufficient allowance

made so that the drawers will slide easily

The cabinet illustrated is 24 by 28 in. with

a double tier of drawers, 12 by 19 in

Each drawer contains its own type of tools.

such as drias, chisels, screwdrivers of va-

better protection to the tools.

its own place and is put back after

rious sizes. Wrenches id hairment. One or drawers can be di and unto small compartments for nots. but s. screws, and miscellaneous hardware.

The diswers of this tool

tove bron cut out

weeness or por &

he sarrous timbs

e a load with left

One method of forming pockets to receive he tools is to draw an outaine around each tool with a flat-sided pencil

on a board about 5 to m. thick, which can be used as a false bottom in the drawer. A jug saw is used to cut out the pattern. Each opening should be smaller than the tool itself so that the tool will set in not quite halfway. The edges can be cut out on a slant or rounded off with a chisel if necessary, and a gouge may be used to cut any deep spots. A felt lining may then he glued in place.

A better and more workmanlike calanet drawer can be made by using a board 32 in, thick for the bottom. After the outones of the various tools have been drawn a gouge is used to cut out the desired form so that each tool rests evenly in a perfectly fitting pocket.-C, B. SMITH.

section being omitted. Gratings for ship hatches and railway signal towers can be prepared in the same way

The diamond pattern makes excellent railings for ship models and can also be used as window each or for lancy grillwork on model houses. To shape and cut the grid, use a rator blade, and smooth up with fine sandpaper

An excellent antique lantern may be made by fastening four full grids together. The top and bottom may be of brass or copper, lightly hammered to shape. Colored glass or transparent material placed behind the grids will add to the appearance

There are innumerable uses for these battery grids, but he sure to get unused ones. Old gruls might still have some of the sulphume acid chaging to them and would be dangerous to bandle, and they are usually hadly corrid-



SLIDING FRAME MARKS DATE ON CALENDAR

A at them band and a square of back paper, used as shown above, make it easier to read the date on any ordinary calendar A small piece of black paper is foided double over a rubber band and passed together, a small space being allowed at the crease so that it will slide freely on the rubber band. A square opening is then cut in the paper through which to observe the date. The mask is used to form a back frame around the current date by sading it along the rubber band daily to the desired position,-Joseph JAMIESON

CALKING WITH RUBBER

To that modern pliable calking compounds of rubber, one must look for other means of applying it than the old puttyknife method. Its tendency to stick in anything it touches makes neatness, economy, or speed impossible. This difficulty may be overcome by obtaining an old grease gun of the screw type, which will eject the subber putty in an endless worm about 1/4 in in diameter,-E. J. Wolack.

HAND REEL ON TOOL BOX HOLDS WIRE SUPPLY

ELECTRICIANS and Wiremen can prevent wice from getting tangled and can keep necessary material within easy reach while working on a Job by using a tool box like that illustrated below, with a small hand rec at ached. The box is carried a ong as the wire is strong Ray B ath



Wiring jobs may be speeded up by mounting a tred on the ardinary alectrician's tool how

The Art of Making Beautiful

INLAID PICTURES

FROM WOOD VENEERS

By William E. Mitchell

Secultivat Abelieve Housewalton, Shehant Robb.





THE WODER USED
This degram shows
the woods chosen by
Mr Mirchell Fairs
setime is also knowed
as cypress crotch;
mottled ambuya an
Bras I sowelnut mottied app as eatin ach.

little more expensive than jeweler's blades, but does not break so readsty. A few extra fine blades with about 70 teeth an inch are useful for very delicate work.

colored picture sawed from wood venecis

Landscapes, figure pieces, purtraits, conventional ornaments—almost anything that can be pointed

may be worked out in veneers. It is best however, to select relatively simple subjects of a type that can be represented by veneers without straining for effect or violating the cappus of good taste.

The inlay picture "Shady Cove" shown in the accompanying illustration has been prepared especially as a first piece for beginners. No great accuracy is required either in copying it or in doing the cutting, but all the essentials of the art may be learned by carefully following out the processes required to make it.

The first step is to prepare a full-size drawing 6 by 9 in, and trace it with India ink in a sheet of ceilulose wrapping materia. The tracing is to help find appropriate grains and swirls in the veneers to be used. The is done by going over the veneer and looking through the index to select the part that is nest adapted for use in each particular detail of the picture. For instance in selecting the sky wood for the picture illustrated the index was run over a piece of mothed ash to obtain the cloud effect. When selected, the part was marked and cut rater. The same procedure was followed for the foliage, water, bank, rocks.



and bluff, and all other parts. It is through this finder that the various parts are visualized.

After selecting the veneers, cut out enough to allow an overlap of 1/4 in, beyond the lines of the drawing. Then take pasteboard the same thickness as the veneer and cut openings into which the pieces of veneer can be fastened in their correct relative positions, as shown in the left-hand illustration on page 74 hasten he veneer with 1/4-in, pummed paper tape. The photograph last re erred to shows sheed waitant for the tree branches, light mahogany for the borison, and faux sating for the beach, all taped. The openings of course, are that marked on the pasteboard by use of the finder.

The object in using the posteboard is to save veneer and reduce the thickness of the pad to be described later. If one does not care about the expense in waste veneer, the pasteboard may be eliminated and veneer the full size of the pad can be used. The leaves of the pad, whether pasteboard or veneer should be cut 7 by 10 in., thus allowing a \$2.00, margin all around the pacture.

THE nest move is to cut two pieces of 1/2-in, whitewood to form the top and bottom of the pad. Lay down one piece of the whitewood and pile on this the various teaves, being careful to arrange them so that the new lines in the drawing will cut through the veneers selected for each part of the picture. When the leaves are all placed, put on the other piece of whitewood to form the top of the pad. Fasten all together by driving brads 1/2 in, in from edge and about 11/2 in, apart

On tracing paper, make a tracing of the drawing and paste this on top of the pad, as shown. All lines are saw lines, and care should be used to follow these with the saw. Drill boles for threading the saw on the edges of the darker wood; these holes are to be filled later with composition wood crack filler. Have the saw blade exactly perpendicular to the saw table. When such fine blades are used, this will give as close-fitting joints as are humanly possible to obtain. Run the saw at 700 or 800 revolutions, and feed (Continued on page 74)

NTARSIATURA, or the art of making inlaid pictures from fine veneers, is rapidly becoming popular among amateur craftsmen. With the aid of a modern electric jig saw, it is comparatively easy to do, yet the results are attractive and valuable. The materials themselves are comparatively inexpensive, and many dealers now stock a large variety of suitable veneers.

So old is interstature that it was practiced extensively in Italy in the fifteenth century. At that time pieces of the utmost artistry were made with very crude tools and materials. The home worker of today, however, experiences few of the difficulties that confronted old-time craftsmen, and for that reason the art is enjoying a revival.

The tools and materials necessary are a fig or scroll saw, several dozen fine j.z-saw bindes, a variety of veneers, tracing paper, a few sheets of transparent cellulose wrapping material white stain-free casein give, 1/2-in gummed paper tape, and some pasteboard. The author uses a blade .008 in thick and .078 m, wide with 38 double teeth to the mch. It has a rounded back and is commonly known as No, 38. This blade is a



AUTOMATIC FEEDER LETS DOG GET OWN BISCUITS

ANYONE who owns a dog can have a lot of fun constructing an automatic feeder. Al, the dog has to do is to step on a board to release one hocast—a trick easily learned, but one that will surprise and amuse your friends

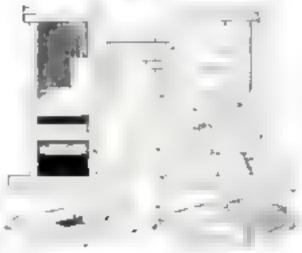
The feeder is designed to hold five dog buscuits of the so-called "mith and bone" variety but it can be made to hold more if its height is increased. Any odds and ends of lumber may be used

The parts are sawed and planed to dimensions, after which the rabbet for the back the groove for the front, and the dadoes for the slide and cover are laid out and cut on the two sidepieces as shown in the photo above, where one side has been

CRAFTWORK

Five Out-of-the-Ordinary Projects That to Construct . . . Fach Has Some Feature





The drawings and, above, how feeder works

removed to show the construction. If no machinery or special planes are available the grove and the dadoes may be worked out with a back saw and chisel. The rabbet may be omitted if the back is made 1/2 in, narrower and merely fastened to the sades with screws.

These pieces are fitted together, and the bole is bored and sawed in the since A piece of tin is then bent as shown and nailed to the back and slide

The trigger may be built up of three 35 in, boards, gloed together. It moves up and down on two dowels fastened to the sides. The block, which pushes out the biscuits, is then worked to shape and fastened to the trigger with two flathead screws. A light coil spring screwed to the back automatically returns the trigger to a horizontal position.

Hold the parts temporarily together with a few nails while trying the feeder When the mechanism works perfectly, it may be glued. The top is then bringed, and the bottom attached with screws. The feeder may be painted or stained and shellacked.—HERMAN HJURTH.

Homemade Electric Roaster Cooks Frankfurters Like Magic





HOT DOGS are cooked as if by magic on this electrical we ner roaster brom one to three frankfacters are precised on the pointed terminals of the device and the current is turned on. Because of the most ture in the weaters, the current flows through them and heats them. They start to swell within a few seconds, and in a minute or two are thoroughly cooked.

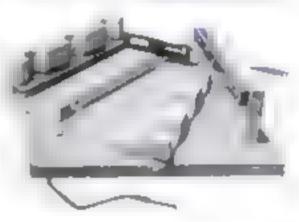
When used for cooking three weiners at once the toaster draws about half as much current as an electric aron.

The materials required are as locows 1 pc. wood 3% by 8½ by 9½ in.; 2 pc. wood ½ by 2 by 7 in.; 2 pc. wood 1½ by 1¾ by 7 in., 12 wood screws, 2 pc. bakebte, hard rubber or other insulating material 3 16 by ½ by 7 in., and 4 pc. 3/16 by ½ by ½ in.; 6 No. 6 or 8 machine screws, 1 in. long, with nuts, 4 roundhead wood screws, ¾ in. long; Z pc. thin copper ½ by 6 in., 2 pc. insulated wire 6 in, long, cord, plug, and switch, 4 rubber-headed tacks, 1 pc. bright tin 7½ by 8½ in.

The first step in making the reaster is to prepare the two electrical panels. Cut out insulating strips as shown from bake-life, hard rubber, or other hard insulating material, and drill holes where indicated. Then cut out the copper strips, and mark and drill the holes. Prepare the machine screws by grinding off the threads at the ends and shaping them to a sharp point

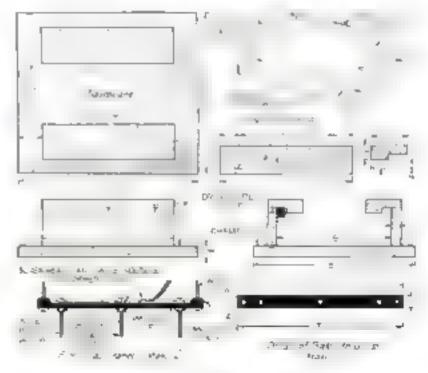
Insert the screws through the copper, then through the insulating material, and screw the nuts into place, thus bolding the copper strip against the insulation. Solder the heads of the screws to the copper strip to insulate a good contact, and solder a 6-in pace of insulated wire to the end of each copper strip. Cut out the wooden pieces

as shown, and mount the electrical panels on the unrights using washers or blocks of insulating material to keep the cupper strips from touch- (Continued on page 77)



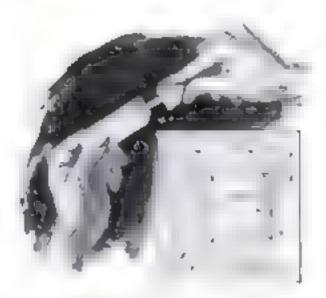
Method of constructing toaster One photo shows it partly assembled, the other shows its underside





NOVELTIES

Are Comparatively Easy and Inexpensive Certain to Arouse Your Friends' Curiosity



RUBBER-BAND TRICK FOOLS SPECTATORS

ILLUSTRATED above is a puzzle that will mystify the shrewdest of your inends. The plug, the projecting end of a rubber band, and the notch in the end of the dowel have no purpose except to mis-rae the animitated. It adds to the deception if the sides of both the block and the cap are numbered as if they had to be adjusted in some predetermined order

To demonstrate, insert the dowel in the hole as far as it will go and twist the caparound two or three times. Withdraw the cap about an inch and, by squeezing the pyramid with the fingers, cause it to snap back again without moving your hands. In the meantime, tell your spectators that by certain twists you had caused the notch in the end of the dowel to engage a rubber band in the hole, and this is what caused the cap to anap back, as you have just demonstrated. Go through the twisting motions again as if to disengage the elastic, and let others try to book the subber band. They will follow your example and twist the cap and brock in all sorts of ways. to make the hook catch.-Hr Storry,

MODERN MAGAZINE RACK DIVIDED BY HOOPS

THIS modern magazine rack is a novel and useful addition to a set of porch furniture. It is equally suitable for yearround use in the living room.

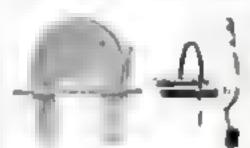
Start with the two white maple ends. which will probably have to be glued up from two or more pieces. Cul them to shape and smooth the edges with a sharp

The wainut overlays for the ends are then cut out, and the exposed surfaces alled with dark paste filler before gluing these pieces in place. The two cherry overlays on each end are stumed before assembling. The antiseptic known as "mercurochrome" is a satisfactory dye for this purpose. It is swabbed on with a tuft of cotton, and followed, when dry, with a coat of orange shellse. When gluing the overlays, apply the glue sparingly so that none will be squeezed out

The base on each end is a simple job of mitering and gluing. The grain of these base pieces should run vertically

Mortise and tenon the rasks into the ends

and cut all the square mortises for the hoops; then assemble these parts and prepare the boops. The writer found that the sapwood of wild cherry



At left above to shown one of the bending forms with a hoop clamped in place. The other photo riustraces he method of assembly, and the drawings appear at the right

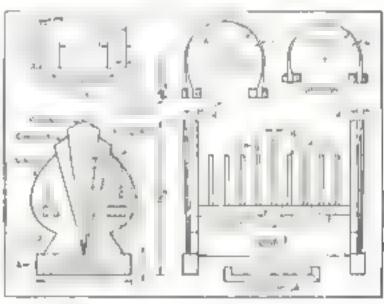


Of unique modern design, this magazine rack may be conveniently carried wherever needed

serves admirably for this purpose. Cut the hoops to the required size.

Cut out forms of the proper shape over which to bend the hoops. Place the hoops in boiling water for twenty or thirty minutes to make them flexible, bend them around the forms, and hold them in place as shown in one of the photographs. When they are thoroughly dry assemble them by fitting them to the mortises in the ratio and making a saw cut for wedging

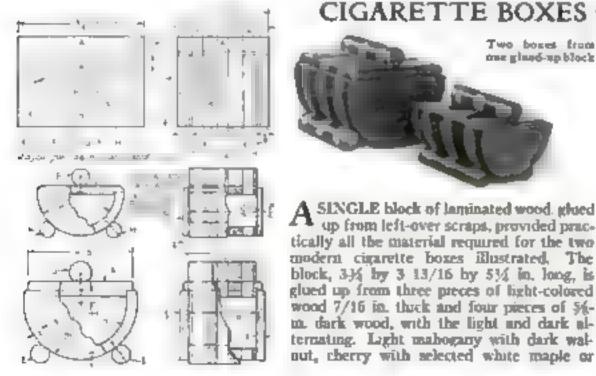
Finish this piece by applying two coats of white shellac, followed with a cost of good spar varnish.—Rogen Moyer.



CIGARETTE BOXES OF LAMINATED WOOD

Two boxes from

one glassi-up block



A SINGLE block of laminated wood, gloed up from left-over scraps, provided practically all the material required for the two modern cigarette boxes illustrated. The block, 334 by 3 13/16 by 534 in, long, is glued up from three pieces of light-colored wood 7/16 in. thick and four pieces of 56-

holly, and resewood with Incewood are suggested combinations. Cut the wood slightly larger than shown and, after gluing, true up the block to about the dimensions given. Take especial care to get the four long sides square with each other.

Across the laminations slice off the piece A. % in thick, from which the lid of the larger box is to be formed. Then, parallel with the laminations, slice off the 45 in thick sides J Carefully plane the remaining block square. See that the lammations are kept central and parallel with the sides.

With a sharp pencil lay out carefully the various parts for band sawing as shown on the drawing. Saw them out to the alphabetical order of their designating letters. Note that one cut shapes the inside of B and the outside of D, also that the small feet and handles are incomplete circles in (Continued on page 77)

N E W

Streamline Plane Model

Only fifteen parts are required for constructing this miniature Crusader



NE of the most highly streammed designs among the new airplanes is the four-place twin-engined, tow-wing cabin monoplane known as the "Crusader" This plane, according to the manufacturer, can take off in eight seconds, has a high speed of more than 200 m.p.h., can fly nearly 150 m.p.h. with one engine, and lands at 55 m.p.h

The cabin resembles closely the body design of the modern streamline automobile and is just as roomy and comfortable it is about 4 ft, wide and seats lour people with ease. Entrance is made through a

door on the right side

The scale of our model in comparison with the full-stand amplane is 16 in equals 1 ft., like the majority of models previous by his color to this series 27 each simple and are required, and these are assert and

By DONALD W. CLARK

rasily with eight metal pins and four common pins. The only cement or glue needed is to hold the four bood caps in place

To make the wings, cut the blank large

enough to take in both the right and the left wing, and shape completely while in one piece. Cut in two and then, from each half, saw out a 1/2-in, section as shown on the wing drawing. The removal of this portion of the wing allows the engine nacelle to be set in without changing the taper of the wing.

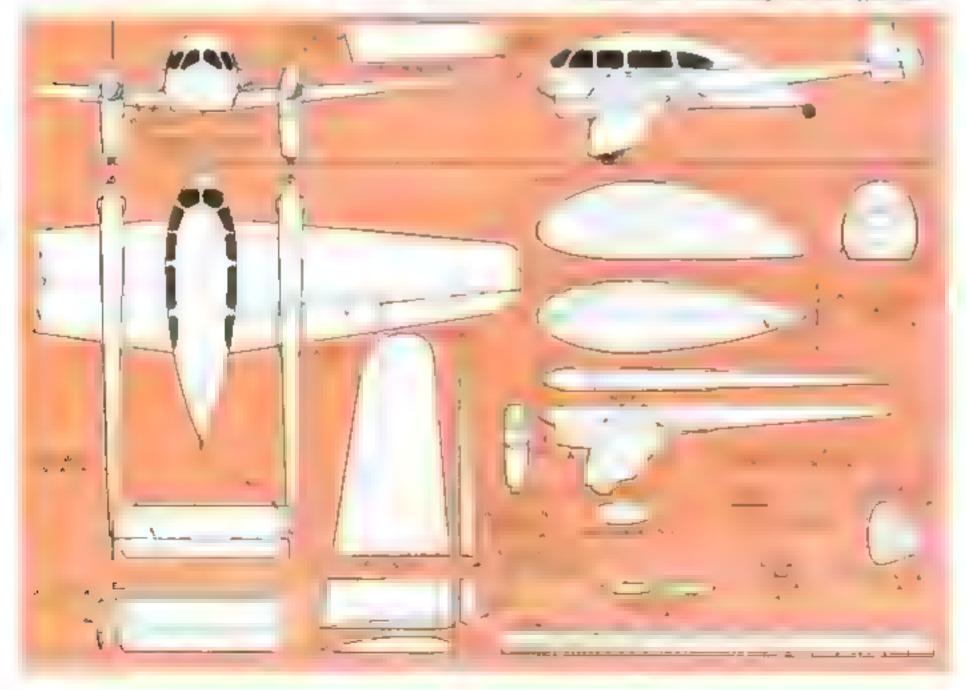
Each of the engine nacelles is designed to be shaped in one pure that the wheels can be made separately and glaced on the red. After the tapered

nose has been shaped, the cone at the end forming the propeller bub should be cut off carefully. Before cutting it, however drill a small hale to take a common parfor assuming the propeller.

As a preliminary (Continued on page 83)



The complete as of shaped parts used in burding the Crusades model. The drawings and even appear below





The saws are hung by pushing them between the rubber caps eshown ergo for clearness.

IAVING a saw down each time it is used is hard on the saw treth, especially if the bench is crowded, as mine generally is Reversing it so as to hang it up by the handle takes time, and sweaty hands soon cause rust spots to appear on the polished steel. A better way is to make quick-acting rubber clamps or hangers, as shown.

The rubbers (two for each saw) can be formed from the shoulder sections of a worn-out auto tire or from rubber heels



CONVENIENT HOLDER FOR LEAD LAPPING BLOCKS

Almost every mechanic, amaleur or professional, who dues lathe work has at times to reduce, or accurately size, cylindrical pieces of hardened metal by lapping. Even unbardened pieces may often be more accurately or conveniently brought to exact size by lapping. Sometimes wooden forms coated with a maxture of oil and fine abrasive are used as laps, but generally lead laps are more satisfactory.

A handy way to hold lead blocks used in lapping is to make a hardwood frame as shown above. It is dovetaked so that the lead blocks may be pressed in. Two long bolts hold the frame together the nuts being loose enough so that adjustment may be made with the fingers. If wing nuts are at hand, they are even better. Call springs placed on the boits between the two parts of the frame serve to keep the lead lap open until the handles are pressed together. Any size hole may be made in the lap to suit the work in hand, and, when too badly worn, the lead blocks may be melted and recast. A lap of this type enables one to do rapid work with a minimum amount of whatever oil-mixed abrastve is used.-A. E. G.

QUICK-ACTING SAW RACK HAS RUBBER HANGERS

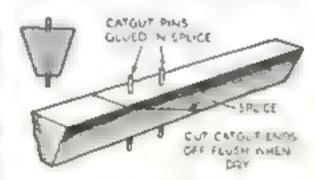
(but look out, when cutting heels, for the uny steel washers that are molded around the nail holes). Use a sharp knife and wet it for each cut. For the baseboard, use its or 1-in, stock. When mounting the rubbers, drive nail B last, and press the points A of the rubbers together firmly

Mount the completed hanger above the beach, high enough so that the saw handles are convenient to grasp. When replacing a saw, showe the end of the blade up between the rubbers—it will find its own opening—and push it up so that the end is 2 or 3 in, above the rubbers. It cannot fall if the rubbers are properly set To release, grasp the handle and pull out toward you, not downward. It comes out so easily that you will wunder what held it up.

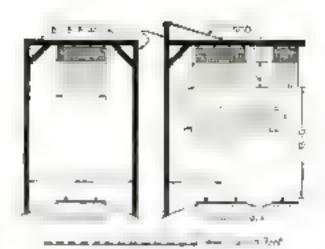
A refinement is to make the baseboard longer than your longest saw and cover the part below the cubbers with any suitable cloth, slightly moistened with a good oil. The teeth of the saw will keep sharp much longer especially in the case of saws that are seldom used. Microscopic rust on the cutting teeth of unused saws dulls them almost as much as though they were being used, if they are not well protected, particularly during damp weather or in a

SMALL V-BELT SPLICES PINNED WITH CATGUT

damp shop,--- WILLIAM R. SPILAGUE.



Appropriately Appropriate Appropriately Appropriately Strong V-belts by gluing pins of catgut (such as tennis-racket strings) as shown above after the usual diagonal splice has been made and allowed to dry. The ends of the pins are then cut off flush with the suctace of the leather. In small belts it is best to use only one pin.—Rocer M. Johnston



MINIATURE TELLTALES FOR MODEL RAILWAY

FOR the model railway system that boasts a tunnel or any other overhead obstruction, it is destrable to supply motature teletales. Rules and regulations demand that teletales to ware let he next atop from the trains be provided at all places where the clearance is less than 21 ft (in some states, 22 ft.). Look over your system and see if this safety feature has been neglected

The drawing above shows to Itales for both single and double track layouts. If your road is built to a scale of x_i' in, to the foot, the framing for eather the single or double track telltale should be made of slender strips of wood. For the smaller scales, use square wire (bus bar, found in old radio sets is ideal) and make the framing all in one paece with the corner braces soldered in place

The wire screening that supports the ticklers should be made of some open weave cloth. Cross-sitch canvas, a stiff, lightweight cloth, is suitable. A piece somewhat larger than the required screen should be painted or stained black and then cut to size. The lower edge of the cloth is frayed out and every fourth or fifth thread left longer than the rest to represent the ticklers. Paint the frame a dark brown to look like creosore.

Place the telltales not less than 100 ft (to scale) from the tunnel or bridge it protects. The tickless should extend at least 6 m, below the obstruction.

Full-size dimensions are shown on the drawing, also a scale in feet so that the telltales may be reduced to any desired scale.—J. W. CLEMENT

OLD TIRE SERVES AS HEAVY-DUTY BELT

THE short-cepter beavy-duty drive belt illustrated at the right is nothing more than a discarded automobile tire casing Service of this kind on a cut-off saw is very severe on any type of belt, especially when used on such short centers, yet the improvised belt has stood up well and given satisfaction for two years. It will be noted that no idler is used in this installation and that the pulleys are flat .-R. H. PRIKENS.



For two years a belt improvised from an old rice casing has driven this circular saw. The above drive makes this acrysta particularly severe

PLANS FOR BUILDING A Four-Treadle

HAND WEAVING, one of the principal domestic grafts of early Coloreal days, is coming to the form as a hobby. An increasing number of requests have been required from tenders for information on building ingli-grads boom. To answer these questions, we mixed Mr. Gottshall, who has built many locous, to prepare a set of plane.

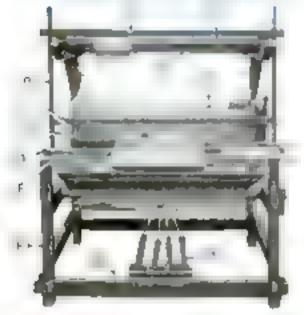


Fig. 1. Photo of the finished from from the working position. Find more important parts are ettered to correspond with the drawings

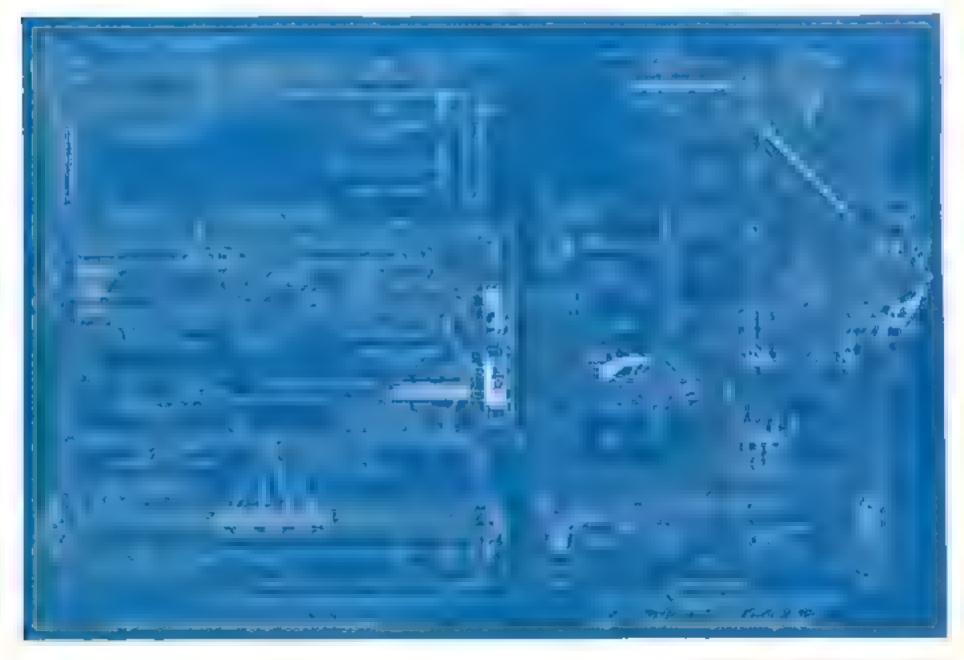
Specially designed for home use, it will weave cloth up to thirty-eight inches wide in an endless variety of patterns

INTEREST in the art of hand weaving is rapidly being revived, and just ly so, for its value as a handscraft from the artistic standpoint can hardly be everestimated. On a homemade hand foom such as the one shown. Colonia, coverlets, throws, numers, table lines, hand bags, rugs, and numerous other articles may be woren, and a great variety of beautiful patterns may be worked out. The covering material for the wing chair described in a previous usue (P.S.M., Dec. 14, p. 63) was woven on this loom, which is large enough for weaving cloth 38 and wing

In order that the construction may be more clearly understood by those who wish to build the loom, it will be necessary to explain briefly the principles involved in its operation.

The warp threads, running lengthwise of the cloth, are placed on the loom in such a manner that certain groups of threads may be separated from others, thus allowing the welt threads, which non crosswise to be woven into the cloth by means of a shuttle. The separating of the groups of thread is called a shed, and is clearly shown in Fig. 2, where the shuttle is about to be passed through the opening of the shed. The shed is made by depressing one or more of the treadies (marked H on the drawing) to which the harness of the norm is tied. The harness consists of ropes pulleys, sticks, and heddles of which the heddles are the most important part. It is by raising some of the heddles and low eriog others that the shed is formed.

Heddles are made by tying two-ply, waxed cotton warp thread into loops, having an eye in the center, as shown in Fig. 4. The heddle, when ned, is about 9 or 10 in, long, and the eye in its center is not more than an toch in length. It is itsportant to make every heddle alike. To do this, drive four nails into a piece of wood, around which the knots may be tied, thus making them uniform. There must be one heddle to each warp threau, which is threaded through the eye of the heddle. Since there are four hedge frames in this foom, each tied to a different treadle, sheds consisting of various combinations of warp threads may be formed by depressing one or more of the treadles. The pattern of the cloth is partly determined by the manner in which the threads are grouped on the heddle frames, and partly



Hand Loom

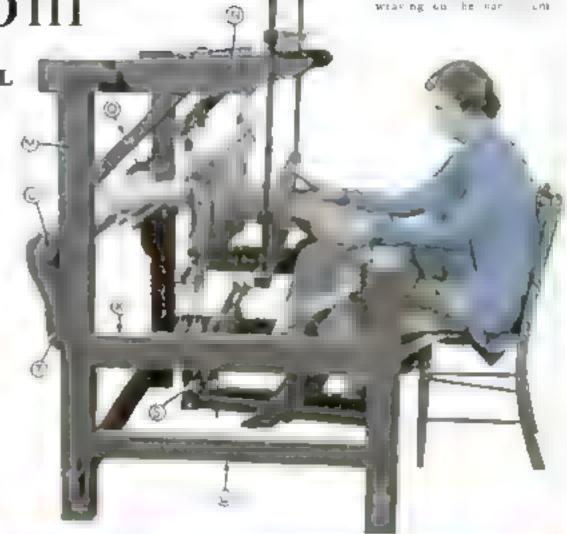
By Franklin H. Gottshall

by the order of treading when the cloth is being woven.

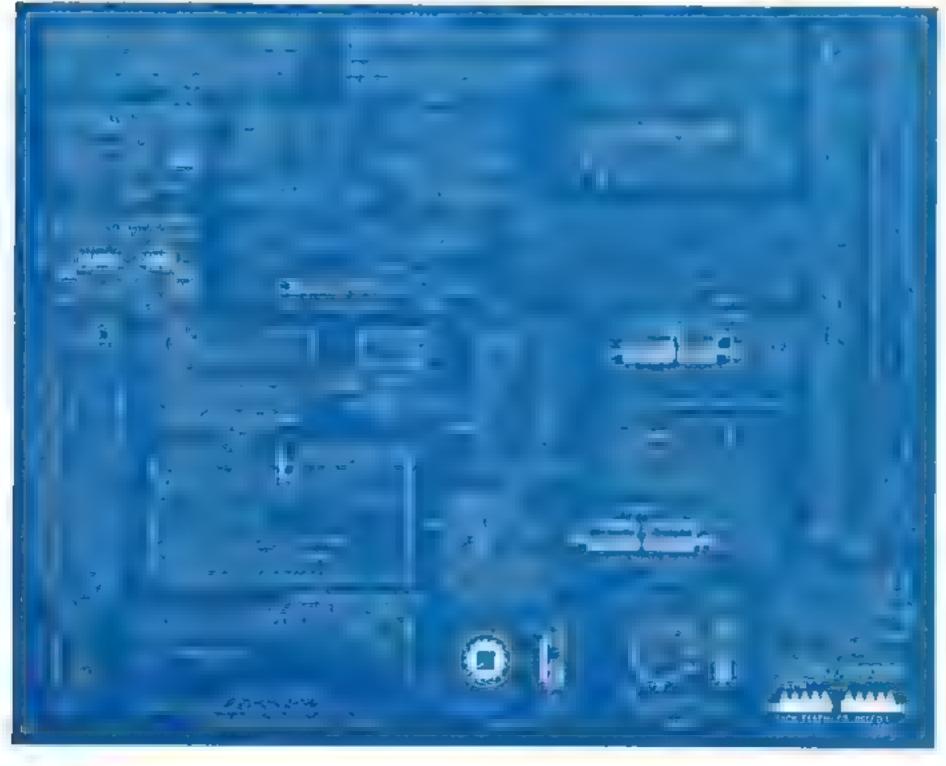
As the west threads are woven in, they are packed as lightly as desired by means of the beater. The beater is a frame holding a series of wires known as a reed (Z), which beats the thread lightly into the cloth, thus completing the weave. One or more reeds are needed, and it is desirable to have at least two. It only two are bought one should be a 17-dent reed, that is, a reed having 17 wires to the inch. The other should be a 24-dent reed. Since these would be very difficult to make, and as they are inexpensive, they should be purchased from a firm where weaving materials are sold. As the cloth is woven it is rolled up on the oth beam.

With this explanation of the principles of weaving, it is hoped that the construction of the loom will become clear upon examination of the drawings and photographs.

To make the construction of the foom as understandable as pass the, the author has indicated the various members with letters, and named many of the parts directly on the drawing. The reference letters are identical on (Continued on page 92)



Pie 2 Mrs Cotrobail



MAKING SHELVES FOR MASONRY GARAGE



F YOU have an attached garage and don't feel equal to fastening shelf supports to the masonry walls, here is an easy way to make portable shelving that stands by strelf. You will need two dressed planks, each 12 in, wide and at least 15 It long 5 ft. of 2 by 4-m. wood; 4 ft of 1 by 2-in, wood; two to-in, fron shelf brackets with screws; and twelve 11/4-81. flathead acrews.

If the garage is, for example, 10 ft. 15/3 in, wide cut off 10 ft from each plank leaving two end supports, each 5 ft long Cut the 1 by 2-in, stuff into four 1-ft

lengths. Screw one of these across one of the \$ ft, supports, 31/4 ft. from one end, and another I ft. above it. Do the same with the other support

At the center of each 10it, shelf, cut a 2 by 4-in. notch, Screw one bracket 31/2 ft. from one end of the 2 by 4, and fasten the other bracket I ft. above it, both on the 4-in. face of the tamber

Set the side supports against the garage walls and put the 2 by 4 in the center of the back wall, with brackets pointing outwards. Commencing with the lower shelf hammer both shelves down on their respective crosspieces, with the center notch-

es fitting around three sides of the 2 by 4 and with the brackets supporting the center of the shelves. The whole afforcan be made such a tight fit that it will be unnecessary to nail down the shelves or fasten the end amports.

Any difference in the width of the garage may be compensated for by making the shelves shorter or longer. A few cup hooks may be screwed under the lower shelf to provide for hanging brushes and cleaning cloths, and a shallow ten-cent baking pan may be used to hold oilers, measures, and preuse guns .- E. T. KRYSER.

long, exactly one quarter the size of the original car. The patterns and parts were

all made by him in this basement shop,

and their assembly is now well under way.

SHAVING TUBE IMPROVES SOLID CRANK HANDLE

A south trank handle on a lathe or other machine can be made more comfortable to use by the sample expedient of supping an empty shaving-cream tube over it, as illustrated above, after the tube has been cut off to the same length as the handle Shape the tube to conform to the handle and on it by removing the cap. It is surprising how freely it turns on the polished handle. The effect is the same as if the crank handle itself were of the revolving type. HALVOR ANDERSON

SCREWS DRIVEN QUICKLY WITH ASSEMBLING JIG



Jug with some I motor in place on a locating plate roady for driving the four end acrews

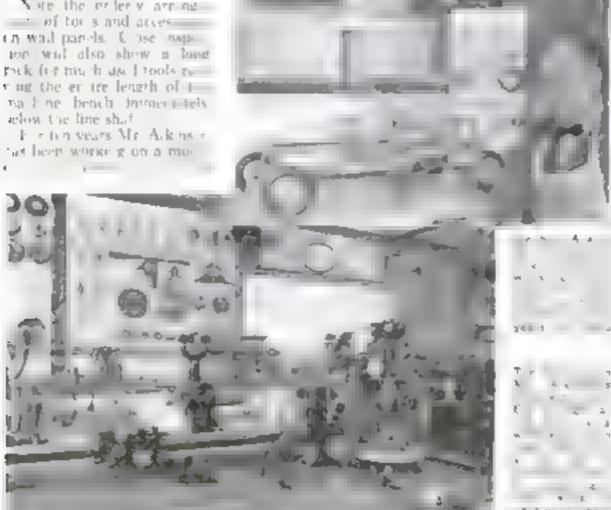
A suor making small electric motors has a screw-driving assembling its that can be applied to numerous other jobs. The screw driver, which as used to set the four screws of the end plate of the motor, is carried in an arm that may be adjusted up or down or swung to any radius and securely clamped in place. On some jigs, _ a small coil spring is used between the handle of the screw driver and the top of the arm for holding the screw driver up out of the way as the work is set in the jig. Much time is saved by using these devices .- A. E. GRANVILLE.

NEAT LAYOUT FOR HOME MACHINE SHOP

MANY photographs of well-arranged small shaps for woodworking have been published in past usues, but here is a home machine alsop of exceptional compactness

and neathern. Its owner is Herbert Atkinson, of New Sere Mass Note the order viarring en wall panels. Unse supton will also show a long

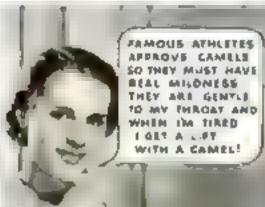
acton the line shaf-



"They don't get your Wind" ATHLETES SAY

SAMO





HOMEMAKAR Mrs. J. B. Ferrey.

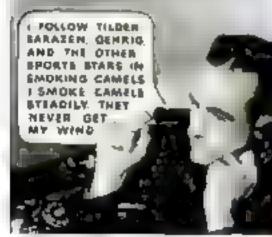


CAMELS OF NOT FRAZZES MY NERVES OR OPSIT MY CONDITION AND THAT CAMEL TASTE IS JUST WHAT I WANT M CONESS COUPLED WITH FULL RICH FLAVORS

ACCOUNTANT C A Pererson

MANY I SMORE THE MANY I SMORE CAMELS IVE SMORED THEM FOR AGES, AND NO MATTER HOW MANY I SMORE THEY DON'T AFFECT MY WIND

WHITER Frieen T ghe



REPORTER - Dick Hungedord

What Bib Tilden has to say about Carrels is worth any smoker's attention. Playing competitive terms day after day, I've got to keep in tiptip p. vs.car condition. says the 12 year old Iron Man of Fernas." 'I smoke Camela, the mild eightette. They don't get my wind of apset my nerves. I've smilked Camela for years, and I never tire of their amooth, field taste! Camela must be made from choicer to accoss to be so mild and taste so good.

Costlier Tobaccos!

Camela are made from hiner, MORE
FXPENSIVE TOBACCOS—Turkish and
Domestic—than any other popular brand,
Gignes? R. J. Reynolds Tobacco Co., Winston-Suem N.C.
6422, R. J. Semilia Lab. Co.,
Co., R. J. Semilia Lab. Co.,

It takes 25 operations

TO FINISH ONE FORD VALVE

E arate operations from the time work starts on a rough valve until it is ready for use. That is a surprising number of opera-

tions for such a simple looking part, but typical of the care used in manufacturing all Genuine Ford Parts.

Ford valves are made in Northville. Michigan, in one of fourteen Ford single-department plants located within fifty nulse of the main Ford plant in Dearborn,

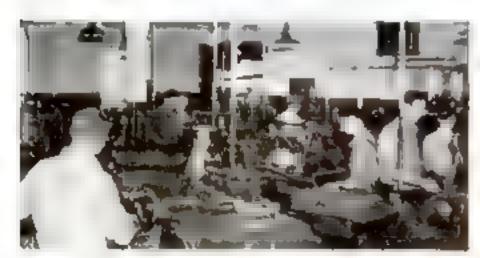
The stems of the rough valves first receive two preliminary grinding operations. Then they go through a furnace where the heads are brought to a red heat. Next, automatic lingers place them in a huge machine where a run strikes the red-hot heads. This operation refines the grain structure in the head straightens it, and forms the valve seat.

Valves then pass through other grinding, machining and polishing operations. Each steat is ground five times for greater accuracy and smoothness. Inspection gauges keep a constant check on the precision of machines.

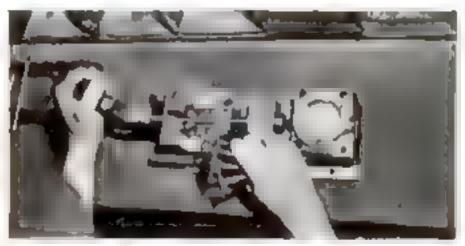
In spate of this care, each Ford valve is subjected to most rigid final inspection. Amplifying gauges check the stem for roundness within two ten-thousandths of an inch. Similar gauges check diameter.

Other inspection equipment indicates the slightest "run out" of seat and checks stem end for squareness. Then the valves go into a constant temperature room where they are inspected for length.

While the difference in length of a valve stem under normal temperature changes is very slight, measuring valves in a room where temperature is controlled indicates the procautions taken in manufacturing Ford parts. That is why it pays to insist on getting Genuine Ford Parts for your Ford our or truck.



A grinding rouse in the Ford value plane in Norshallo, Birkigas



Longth of value is checked under some spring pressure as in angine



Option and mechanical population gauges check policy stem discount



Balling the Ford wine on valve to protect you against substitution

FORD MOTOR COMPANY . DEARBORN . MICHIGAN

Six Kinks for Car Owners



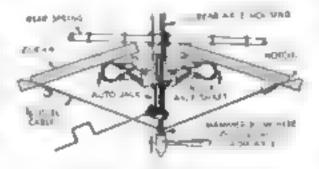
Plug-In System for Emergency Lamp

AHANDY outlet receptacle for a portable trouble lump can be installed easily in one of the rear-spring inspection holes located on the splash pans of most older-model cars. Belted in place and connected into the lighting circuit it will always be ready to receive a standard

plug attached to the end of the troubleught wire. If desired, an outlet can be
placed on each side of the car. On cars
having no inspection holes, the receptacle
can be mounted under the dashboard, on
the motor cowl, or on the floor boards,
as convenience may dictate—W B L.

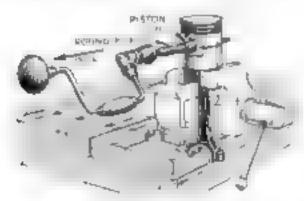
Removing Wrist Pins

INSTEAD of trying to knock a stubborn wrist pin loose from its piston, use an ordinary rat-tail file in the manner shown Simply clamp the piston in a vise, fasten the file in a brace, and insert the file tip in the hole in the wrist pin. A pulling and turning motion will draw the pin out.—E.N.



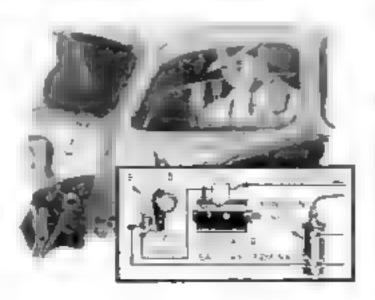
Pulling Balky Wheels

AFTER trying, without success, several of the approved methods of removing wheels, I devised the rigging illustrated. It consists simply of two long pieces of lumber (two-by-fours) notched at their outer ends, a length of cable, and a regular tire jack. Due to the leverage of the boards and the power of the jack, a single hammer blow freed the wheel.—T W B

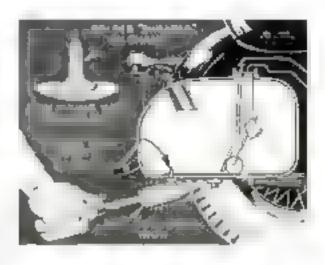


Pilot Light Warns of Ignition Trouble

BESIDES indicating whether or not the generator cutout on your car is operating, the pilotlight arrangement shown also serves as an ignation-key signal. Lighted with the motor running, it shows that the ignation is on but that the generator cutout is open. Not lighted with the motor running it indicates that the generator is operating and the cutout is closed. Because it also glows when the ignition is on with the motor not running, it provides a good telitale that will serve to remind you that your and on switch is still turned on.—P € B

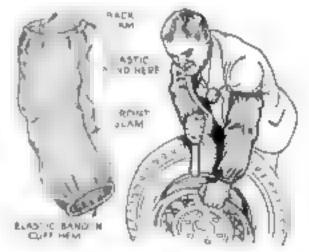


Motor-Wise Readers Pass
Along These Time-Saving
Ideas That Simplify
The Problem of Keeping
Your Automobile In
First-Class Condition



Easy Gas-Tank Repair

BY MAKING use of an ordinary thumb tack, pen holes in the bottom of a gas tank can be soldered easily without removing the tank from the car chassis. First drain the gasoline and clean a spot around the hole. Then flux the spot, take a brass thumb tack, and, after fluxing the tack and aweating solder on the shank insert the shank in the hole and hold it there with the tip of your soldering iron. I mally, replace the from with a screw driver and hold the tack in place until the solder hardens.—N E.



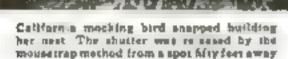
Shirt-Sleeve Protectors

ROADSIDE repairs and clean ahirt sleeves are a poor combination, even when the car owner takes the precaution of rolling up his sleeves. A simple solution is to aid a pair of emergency sleeves to your tool kit. By cutting a pair from an old shirt and adding elastic tape at their tops and hottoms, you can provide yourself with a pair of sleeve covers that can be slipped into place easily. If preferred, a regular pair of fabric arm guards can be purchased for the purpose,—D J A.J

Mousetrap Photography

A SURE FIRE WAY TO SNAP CLOSE-UP PICTURES OF BIRDS AND ANIMALS IN THEIR NATURAL SURROUNDINGS

By RICHARD W. ROLPH



OST amateur photographers at some time or other have an overwhelming desire to make close-up photographs of wild animals or birds. Perhaps it is a bear or deer in one or the national parks, or a squirret in a nearby wood lot, or just an interesting bird's pest out of reach in your own back yard. It is very easy to make a good close-up photograph of any subject that will not allow you to approach it merely by using some string and an ordinary mousetrap to operate the shutter of your camers

One of the accompanying illustrations shows a mousetrap photographer preparing to take a picture of a bird's nest. Exactly the same method could be used, of course, to get pictures of birds in a garden bird bath or entering a bird house

In this case, the camera was first focused upon an object on the ground about the size of a bird's nest and set at stop F/16, shutter speed 1,25 of a second. Panchromatic film was used. The tripod legs were nest strapped to three long poles, and a string was fied to the camera shutter release. This unusual tripod was then raised to the correct focus or distance from the corners to the pest.

The string from the camera shutter release was tied to a mousetrap, which was clamped to a stake driven in the ground, and the end of another long string was tied to the bait hook after being passed through a screw eye in the end of the trap as shown in the detail photograph. The trap was set in the usual way. With this arrangement, a light pull on the long string will spring the mousetrap, which in turn pulls the camera shutter release and thereby automatically takes a picture, even though you are bundreds of feet away

Here are a few tips for the amateur to remember when making a set-up of this kind. If your camera is of the kodak type, set the focus for 3 or 4 ft. with stop F/8, shutter speed 1/25 of a second. This should be about right with most film, however I am taking it for granted that it is a bright day and sunlight is striking the nest. If the sun does not shore on the nest,



it is usually possible to reflect it on by means of a mirror

When you have your tripod set up, it is a good idea to guard against slipping by tying a rope from leg to leg to act as a substantial tripod brace.



The mousetrap ready for apringing the chutter and, left, the complete set-up

An important thing to remember is not to have the string tight between the shutter re-case and mousetrap. Have just enough siack in the string so that when the mousetrap is sprung, it wilpull only the shutter release and will not jur the entire camera. A few preliminary experiments will show how much slack is required.

Although I have described only one setup, the same procedure and method can be used when taking close-up photographs of any timed wild animal. One variation is to place some food or something sweet so as to attract the animal into focus

Artistic Photos Taken by CANDLELIGHT

WiTH no other light than a candle, many artistic still life photographs may be taken. The accompanying example was made as follows

The table was covered with brown paper, held to the wall with thumb tacks and allowed to hang in a natural curve. The brass candlestack was placed in the center of the table, the glass, half filled with tak, in front and to the left. The camera was set up directly in front, o ft. from the candle, pointing down at about 25 deg. towards a point 2 in, below the wack. Focusing was done on the marest part of the candlestack. An exposure of 20 seconds at F/4.5 on panatomic film was given, but 13 seconds would have been more pearly correct. The film was developed in fine-grain developer and fixed and washed in the usual manner.

In this work it is best to use some type of yellow-sensitive film, and an F/8 or faster lens. A good tripod is also essential.—ROSALD L. IVES.



Here's everything you need for

CANDID snapshots show people as they treally are—unposed, natural, doing things. And Kodak offers complete equipment for such pictures—camera, film, enlarger.

Kodak Retina, the up-to-the-minute miniature camera shown here, has a fast f.3.5 lens and an accurate timing Compur shutter. Compact—it can be carried and used without attracting attention. Complementing the camera . . , three speedy Kodak Films and a miniature enlarger.

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The Reting costs about half as much as other cameras of similar range, And it offers every desirable feature.

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All these features make the Retina a photographic masterpiere, yet it costs but \$57.50.

KODAK MINIATURE FIILATOU

The Kedak Ministure Enlarger has been superially designed for candid camera with Enlarge Retina pictures to 9% a 14 inches.

Apapar cabinet base to aptional equipment Price for enterior paper holder, Abactifment f 4 News, \$7.50 Paper cubingt base, \$10 entra.

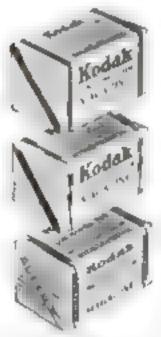


kopan Panatomic Film ideal for enlarging, Entremely fine-trained fully color-benetive. Fact mough for ad normal

pictures.

Kopak "14" Film a blab speed film for general use Fully punchromatic For enapebota indours under artificial light

ROBAR SIPER I PILM Internal deportures (n.d.) in light on the stage . . of night sporting events, An sorm-fast film—considerably faster than "SS." Left you get the fall speed from Your converts.



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SUBSTANTIAL electric furnace for melting metals, heat treating brosing, glassmaking and many other uses can be made by the home mechanic for less than two dollars. Various types and stees can be made; but a good general atality furnace, going to about 1,500 deg. F. on 700 watts, will have a heating chamber about 3 in. in diameter by 6 in. deep. It will take a 21/2-in, diameter fire-clay crucible and will melt two or three pounds of metal.

Obtain a tin can at least 6 in, in diameter by 5 in, deep. If a paint can is to be used, scrape off or burn out every trace

of paint.

A good material for the outer lining is a mexture of equal parts of Portland cement and asbestos pulp. This latter is a dry white powdery material that can be bought in bulk for a few cents a pound at most large hardware stores and furnace repair shops. About five pounds of each will be needed. If, however, the asbestos pulp is not obtainable locally, an equalquantity of fine sand may be substituted although sand is pot so good. The in

By LEO G. HALL

gredients should be mixed dry. Knead out all lumps and continue mixing until the powder is unaform in color throughout Then add water a little at a time and knead until the cement is a moist, crumby mass, but not so wet that water can be squeezed out of it in the hand. Ram a layer 13/2 in. deep into the bottom of the can with a heavy stick or fron bar, using considerable force. This layer is a solid support for the form to be used in making the cylindrical part of the lange (Fig. 1)

THE form, 41/2 in. in diameter by about B to, long, must be made collapsible so that it can be drawn out after the lining has been molded. A piece of pipe or tubing, or an old bottle, 31/2 or 4 in. in diameter, tightly wrapped with asbestos paper to build it up to the required size, will serve the purpose. The asbestos paper can be held in place with a few turns of friction tape. Most large bardware stores sellasbestos paper for a few cents a square

The form, which should be made before the cement is moistened, is set upright in the center of the can, on the cammed-in bottom, The cement then is rammed in around the form as compactly as possible, Take care to ram equally on all sides of the form so that at in not crowded away from the center. To obtain uniform compactness and best wisulation, the cement should be put in by layers, 1 in, or less deep. Ram in each layer thoroughly before adding the next. The limog is built flush

with the top of the

can and may be finished off with a putty knife or trowel. For finishing, have the cement a little more moist. The core is then pulled from the form, and the asbestos paper torn out.

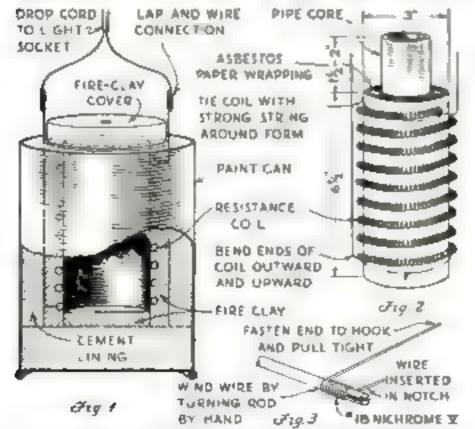
Give this first lining about a day to set before molding the inner lining. It must be kept mout while setting. The setting may be hastened, if desired, by painting the surface with a coat of water glass diluted with an equal volume of water, Undiluted water glass is too thick to pene-

trate the pores of the cement.

The furnace is now ready for the inner lining, into which the electric resistance is moided. This resistance should consist of 40 ft. of No. 18 michrome V wire or 36 ft. of ordinary No. 18 nichrome wire. The former is better because it oxidizes much more slowly and has a much longer life A smaller, shorter wire having the same resistance could be used, but it would not iast nearly so long. The wire must be coiled on a 1/2-in. round rod about 2 ft. long. If a back-geared lathe is not handy, this coil may be made by mounting a breast drill in a vise, clamping the rod in the drill thuck, and turning the crank with one hand while feeding the wire onto the rod with the other. It also can be made by cutting a potch in the end of the rod with a back saw (Fig. 3), slipping the end of the wire into it, and turning the rad with the bands while winding the wire upon it The wire must be kept tightly stretched to make a close cost.

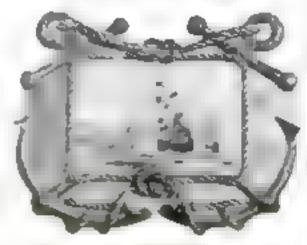
ABOUT 8 in, of wire at one end and 2 in at the other must be left straight. The coil is slipped off the rod and stretched out about 6 It. Take care that the stretching is everywhere uniform, and that all the turns are equally spaced. The coil must now be wound on the form for the inner Liniting

This inner form, like that for the outer luntage, may be made of asbestos paper wrapped on a pipe core so as to have a diameter of 3 in, and a length of 8 in. (Fig. 2). The long end of the resistance coil is fastened 35 in. from the buttom of the form by looping a strong string around it and tying the ends around the form, as shown. The coil is then wrapped tightly around the form (Continued on page 82)



Cut-away view of the Jurance and method of winding the resistance coil

CROSSED ANCHORS FRAME PICTURE OF SHIP



Plysmood, cope, and decorator's clay are combined in making this sautical picture mount

YOUR favorite ship picture or an enlarged photograph of a ship or ship model can he given a mautical setting by mounting it on a plaque like the one shown.

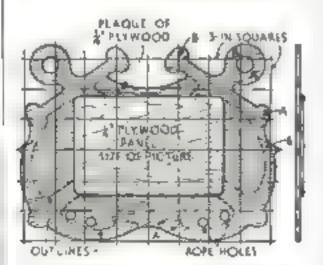
Make a pattern on wrapping paper, trace It on a piece of 54-in, plywood 19 by 24 incut the outline to shape, and make the hotoindicated. Cut another piece of plywood the may of the picture and give it centrally on the face of the plaque. Then give the face and edges of the plaque one cost of white shel-

From an art store got two 1-lb. cans of molding clay and a small can of stipple clay Roll large dain of the molding clay between your hands until soft, and build up the anchors with it. Tacks may be placed in the plywood for reinforcement where the clay is used In shaping the anthors, points A are made higher than points R

A layer of stopple clay from 1/16 to 1/2 in thick is put on the plywood between the anthom and the board on which the picture is to be praced. Use a small, still brush to get the stipple effect, Allow from 24 to 48 hours for drying, then mandpaper the rough places on the anchora,

Next mix some gold bronze with "honana" nil and point the clay and the edges of the plaque. When this is dry, mix some burnt umber with turpentine and paint as before. Let this set about a half hour, then wipe off the stopple work with a rag. Wait another half hour and wipe the anchors, which should be darker than the stipple.

A pleasing effect may be had on the stipple work by daubtog on all colors that will har-



After the plaque has been cut out a thin. penel the sare of the pasture is gased to at

monite with the colors in the picture and blending them together with a rag before completely dry

The picture is now glued in place, and a little floor wax is spread over the face of it with the Sugars. Two pieces of 1/2-in. rope 6 ft long are nailed on, and tied, as shown, then | painted gold bronze. - J P KNIPP

gives greater comfor Diagram should burner, heat directing thus.

tern and remove able fuel tank



Presenced shoctors on three sides of the Brut-Director may be opened independently at day desired angle to DIMECT heat vayor

HERE'S a new beathe that gives comfort plus convenience—proved by thousands in use all over the country. Here's modern heating without ashes, without extremes of temperature - clean, steady oil brotting for store-brated homes, stores, offices and meeting halls, The new Superfex Heat-Director combines the best festures of both circulating and radiating methods, and directs best rays where you plouse.

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comfort. Think what this meaner you can have a gentle fire all night and get up to a comfurtable house in the morning; or you can leave the Heat-Director for a day, a night, or a week-end, with the furl tank full, the dial turned at "low". I hen you return, the place is worm, and the temperature con then be increased at will by turning the deal for higher fire.

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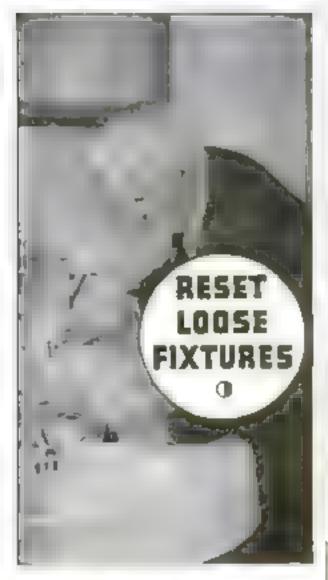


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called Plastic Wood, is the wonderful new discovery for resetting loose bathroom fixtures, loose tiles, filling cracks around bathtubs; cracks in shelving, drainboards, holes around pipes, damaged toilet seats, baseboard cracks, leaky windows; fill old screw holes, holes around wiring, cracks in porcelain, cement, and 1001 other uses. Just press and shape this putty-like preparation into place and it dries quickly to hard, permanent wood.

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the Genument all leading bardware, paint or department mores.

PLASTIC WOOD COMES IN GANS AND TUBES—IN D COLORS IN-CLUDING WHITE



PLASTIC WOOD

THE ART OF MAKING INLAID PICTURES

Louimurd from page 612



the work slowly. First saw out the center and the small parter, taking care that the saw does not period and states these pieces. It is advisable to use a pointed stock to press session on them just as the saw tompletes the cut and hold them in place until the saw is stopped. As these givens am placed in a box lid or shall w box until ready for assembling. The parter along the edges of the drawing are sawed out about 36 in beyond the edge.

When the ig-saw cooling has been completed, clamp a straightedge along the odees of the drawing and saw through the jud with a miter or back saw. Place the parts than freed in the box lid until all four edges have been sawed. Be sure to cut all four edges square.

Lut a piece of walnut or mahogany 5-ply wood, having one good side about 1 or 13% in larger all around than the drawing sity 9 by 5 in. You are then ready to assemble the picture, and this is done somewhat on the order of a ng-saw puzzle.

Take a piece of fairly stiff wrapping paper and cost one side with rubber cement, such as a used in repairing rubber tires. Assemble and cement the sawed-out parls on the paper, face side of the picture down Be sure to get the juints as light as possible. When it is impossible to get a perfectly tight joint have the open joint next to the darker wind so that it may be filled in later with composition wood crack filler, or a in stare of very line sawdust and rive to match the dark wood.

When this work is completed, cost the piece of plywood with white casein glue on the infector side and glue the assembled parts to this, paper side up. Put the assembly in a clue press, or clamp it securely in any convenient way and leave for twelve hours.

When the work has been removed from the press, take hold of one edge of the paper and pull it off after which wash off the rubber cement with a coarse cloth and gasoune. Fill in all dri, holes and open joints.

The picture may either be framed or made into a plaque, with or without a border according to the traitsman's own ideas.

There are various ways to finish the work. I find that the less sanding is done, the more artistic the result. If you wish a smooth, glosay finish, however start sanding with No. 2 0 garnet paper and finish with No. 6 0 Sand each wood in the direction of the grain and use care not to overlap, as sanding across

Then apply three couts of clear lacquer or white sheliac rubbed with very line steel wool and finally with rottenstone and oi. A simpler and very satisfactory finish may be obtained merely by approas two or three coats of the steel resect oil and rubbing between coats with a soft rig. Each cost should be allowed to stand ten or fifteen minutes, then be subbed perfectly dry. Wait at least twelve hours before applying the next coat. The more rubbing, the greater the sheen. Bleached lineard oil does not darken the wood like boiled on

In "wooding," that is, in selecting the different veneers, the light-colored woods are the background, and the pieces gradually become darker until the dark woods form the foreground. For thetanon, the sky is the lightest in color, and water is a shade darker no matter in what part of the picture. There are also occasional pictures in which the general rule is reversed. Only from experience can one acquire the art of wooding. It is advisable for the beginner, after making the picture "Shady Cova," to purchase designs accompanied by the woods. Two or three such designs if carefully followed, will give considerable practice.

When necessary, veneers may be stained before being cut, but I have never required this artificial and its making up a picture. Small pictus may also be shaded by scorthing them slightly in hot sand, but the same effect can be obtained more asturally by choosing wood in which the color varies from light to dark

NEWS OF GUILD CLUBS

Cause have just been chartered in Auburn, Calif., and Collingswood, N. J. Ray O'Reilly is president of the first, and Michael J. Rudolph of the second.

Middletown (Conn.) Howevoorkshop Club. At the annual exhibit James Henderson won the Popular Science Craftwork Medal for a number tilt-top table. Second prize went to W. Kenneston for an inlaid walnut telephone table, and third prize to Mr. Henderson for a mahogany coffee table.

Topeka (Kan.) Homeworkshop Cinb. The grand sweepstakes prize in the country-wide bird house contest, of which this ciub was one of the spousors, was awarded to Dale Calhoon of the Washborn (Topeka) High School. His entry was a martin house built from Popular Science Monthly plans.

MODEL MAKER'S CABINET FOR UPSTAIRS USE

A as a model making workshop I needed a tool tack which would not mar the waits and also some shelving for various small anadies. Two Inexpensive all metal suphoards were therefore purchased, 5 ft. 6 in, high, 14 in wide, and 12 in deep, with doors. These may be found in most department and housefurnishings stores.

For the tool ruck I cut a piece of three-ply wood 40 in. wide by 30 in. high. On this I screwed three 3/2 by 1 in. buttens, with short pieces of varying widths between the battens and the panel so that the tools could be inserted in the openings as shown. The lowest batten is 6 in. from the shelf, and the other

Iwo are each \$55 in higher



A self contained and use ty moved tool rack with mutal cabinots as each and for supplies

Next, I cut two I by 2 in batters and screwed them vertically to the back of the cuphoards on the inside corners, leaving one had projecting I also cut a shelf the same length as the panel, and for this screwed batters to the ades of the cabinets in such a way that the shelf would sade under the panel and support it from the bottom. Washers should be used under the heads of the screws used for fastering the batters to the cabinets, to prevent their pulling through

When the buttens were in place, I set the cabinets upright screwed the shelf in position, set the panel on it is rewed that to the batters, and then got someone to help me lift the white against the wall. Another shelf may be laid or fastened across the top, and another lower down, if you wish, but I use the space at the bottom for my scrap wood has and the

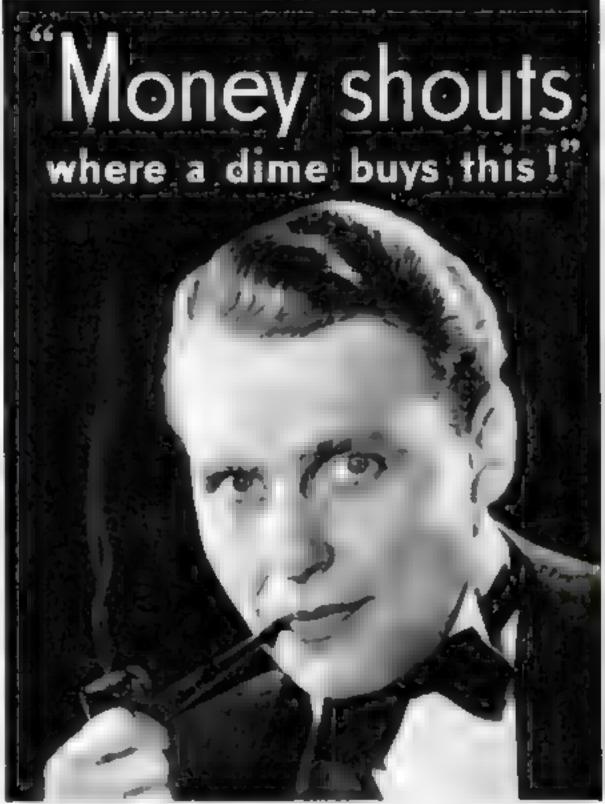
like

For heavy trads that will not go in the rack, I punched holes in the cabinets and asserted large hooks made of stiff wire. There are also a number of cup hooks screwed into the batters — P. O.N.

ATTACHING INITIALS TO CELLULOID RINGS

Winle making a cell and ring in described In a previous is in (PS M Mar + p. 6) I hat upon a novel way of attaching initials If you put a drop of acctone on the front piece of he ring and press the thin celluloid in piace it leaves marks which are next to impossible to remove, because you cannot possible the ring around the small initials. My plan is as follows:

Cut the desired in tall in this ceitained of a contrasting color to the front piece Fasten the amush on the front piece (which should be perfectly level) with ordinary gloe Scrape the male from the edges of the initial with a pointed knife. Then half fill a metal ar lid with acetone and, holding the back of the ring between two finers, dip the front in the acetone till the initials are covered. Hold the ring for half a minute, then lay it down to dry thoroughly. This welds the initials on the ring.—E. F. Thore



RALPH BELLAMY, well-known motion picture star, Union Leader smoker mice 1912

I USED to buy tobacco on the theory that the more you pay, the more you get. Then I learned that my arithmetic was all wet. Because the mellow, old Kentucky Burley in Union Leader packs more smoking

enjoyment than any fancy pipe mixture I've ever smoked—and it costs me one dime. When you halve your expense and double your pleasure—that's the kind of arithmetic I'm fond of. (Great in cigarettes, too.)

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STRIP HELPS TO FOCUS ENLARGEMENTS

WHEN using photographic enlargers which do not have the automatic focusing feature, it is often rather difficult to get the image on the enlarging easel exactly in focus. Much time is lost in focusing, and the eyestrain is considerable. A device to aid in this part of the work can be made quickly

Cut a strip of paper, preferably black, about 2 in, long, the worth being one fourth the diameter of the enlarger lens. Put this strip across the front of the lens as shown, and secure it with a subber band. When the image is out of focus, two nearly superimposed pictures will be seen on the easel; but as the point of correct focus is approached, the two pictures will blend into one. Of course, the paper strip is removed before making the enlargement, although leaving it on will do no harm except to lengthen the exposure required

If you prefer to make the device of metal, rut a piece from a discarded film-pack holder and hend the ends so that they will press lightly against the less barrel.—W. C. Vesyal.



Formering strip applied to an enlarger lene. White was used to this take so it could be seen, but black paper or motel is preferable

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TWO CIGARETTE BOXES

(Continued from page 63)



Trimming the sides after they are gland on

section, having Rats in their circumference. Most of the finishing may be done on drum and disk sanders, using a fine grade of paper about No. 1 for forming and No. 00 for finishing. After sanding the inside of D and B, glue the sides J to B and two pieces of 1/4 in thick dark wood to D. These last mentioned pieces of wood, each 2/4 in wide by 3 in long, are the only extra material required.

The sides of both boxes should be left "in the square" and trimmed to size after being glued in place. Form and polish the feet and handles is P, C and H on the sander Fig. lids, and brad and glue on the feet and handles

To obtain the utmost contrast, finish with white shears or with cient lacquer. A smoother finish, however, may be abtained by putting on a very thin coat of transparent filler. Cover the finer with several coats of shelize or with rubbing varnish.—Donard A. Pascu.



The nutside may be finished on a dish sander

ELECTRIC ROASTER

Continued from page 62)

ing the wood, Bore holes through the aprights and run the wires from the electrical panels through these holes, and thence through holes in the base.

Place the shaped toppieces over the panels. Mount the base on rubber-headed tacks, and put a switch either on the base or in the electrical rord itself. A tin drip pan, made to fit between the uprights, will protect the base.

To use, turn the current off place one or more "bot dops" on the terminals, and turn on the current.—W T BASTER.

PRIZE WINNER

Forestar W at the page of 6 Th

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And estyles play a part in every home works shop project. In decorative metal work it to a major part. Here the fractices which distinguishes prize winners from just average pieces is definitely determined by the alirasive. For that reason craftsmen such as Mr. Sovieti choose Carborundum Brand Products, whether for shaping, surfacing, finishing buffing or sharpening wood and metalsworking tools.

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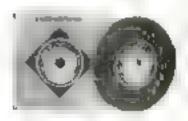


ALOXITE BRANG CLOTH

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Fig. I for left). Unbrenkable a af stecking appearance, this "-- h sight is easy to construct 1 g 7 (abaye). Used as an upthe ampler (emperary light an

ELLULOID from an old auto side curtain or any other clear collutered can be used for making the modern-look vest-pocket size flash light shown in Fig. 1 It has a striking appearance, twemtnumature Teha coll, and could be for a futuristic "beat ray, project of I p unbreakable and w stand a sot

around. It uses an unbreak able 2 5-volt lamp with solid glass bulb, custing a prefocused spot beam (shhough an ordinary bulb would do)

First get a b-in, piece of Sprin, bardwood dowel. Wind. this closely with either No 20 copper wire or No 22 brass wire, the ends being held in holes in the ends of the dowel. Around the wire wrap tightly a sheet of clear

cellulands enough for three thicknesses. The cellulaid is "welded" into a solid case around the wire with a solveat consisting of one part amyl atetate ("banana oil") and two parts acetone. Paint this mixture on the first three inches of celluloid to be wrapped (Fig. 3) un-

til it is quite fictible and can be wound on without air bubbles. The softened surface was all the depressions between the turns of wire For wrapping the remainder, me plain acetone, rolling up the celluloid immediately it is applied. After ten minutes, carefully knock out the hardwood dowel core, and allow the case to dry over night

With a file, smooth the outside, particularly the line left by the ridge. Finish with fine sandpaper, and restore the glow by painting with accrone. Trim the ends to give a length of about 5 m.

To make a cap for the bottom, wrap and cement a narrow strip of cellulard around a short, flathead screw. When this plug has been built up to form a rather loose fit inside the case, wrap it taphtly with copper wire as shown in Fig. 4. Apply acctone so that the wire will sink into the surface, also see that the wire makes good contact with the strew Cut two pieces of red celluloid toothbrush bandle, file them flat, and coment the edges together (Fig. 5) Round the piece with a file and cement it with accross to the wire covered play, which fits into the bottom of the case as shown in Fig. 6. The turns of wire on the ping, and in the case, serve as threads. When the flash light is completed, a turn of

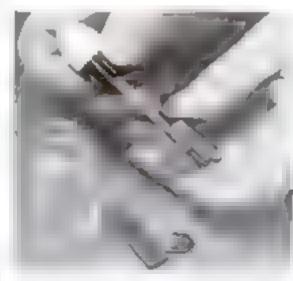


Fig. 5. Comenting together two flat pieces to make a disk for the plug shows in Fig. 4



Pig. 6. The plug, with disk ettached, fits like a acrew into the and of the flash light

the cap makes contact and flashes on the light. Around the threads of the bulb, wrap more turns of wire, then wrap with a narrow strip of cethiloid, using accione for cement unit of forms a socket fitting tightly in the top of the case. Figure 7 shows the socket partly made Bend the end of the wire into a loop so that, when it is inserted in the case, it will make contact with the turns of wire in the latter Cement the tocket in place with ceituloid scrape dissolved in acctone

Attach a heavy pencil clip. To do this, cot away that part of the clip which ordinarily passes around a pencil, leaving only two proups. These may then be present into the case and remented.

Figure 2 shows a novel way of using the flash light as an upright itimp for temporary lighting. Wrap a 1½ by 5 in, strip of celluloid into a tube that fits the top of the case tightly in one end of the tube cement two celluloid datas. "Frost" the issues of this shade by rubbing the cessuloid with sand-paper until it has the white appearance of ground glass.—E. A. Bowns.

Suggestions from readers are invited in regard to making traftwork projects from cellulard and other modern plastics, either in the | form of thin theets or rods and tubes

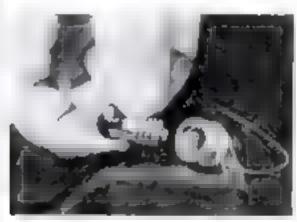


Fig. 7 Partly finished socket with wire us, the inside that makes contact with the case

CELLULOID SIMPLIFIES SHIP MODEL MAKING

In constauctive numerous ship models, I have found it difficult to point the cabin doors and windows neatly on wood. It was always a time-consuming job, and the results were never quite untulactory. Now I make the doors and windows on an overlay of sheet orilatout-not clear, but preferably of a cream or ivory color. An advertising calendar and an old celluloid card tray have provided ma-terial for several models. The surface is prepared by rubbing it with fine sandpaper Lines may then be drawn on it with ink, or paint may be used if preferred. When this has been done, apply a protective roat of clear varnish and coment the celluloid in place Cream or ivory colored celluloid also is excellent for ship-model name plates and for insays for various purposes.—E. A. Darwen.









Bon't let adolescent pimples give YOU a hated nickname!

Between the ages of 13 and 25, important glands develop. This causes disturbances throughout the body. Waste poisons get into the blood and irritate the skin, making it break out in pimples. But you can clear these skin irritants out of your blood—with Fleischmann's Yeast. Then the pimples disappear?

Eat 3 calces a day, before meals!

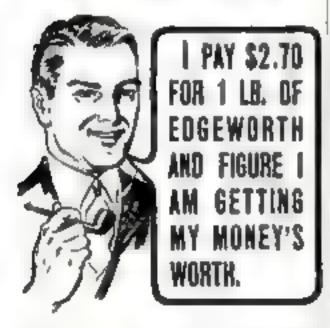
-clears the skin

by clearing skin irritants out of the blood

Coperigie. 19th, Mandard Brands Incorporated

BOY, YOU PEOPLE SURE ARE LUCKY





"There's body to Edgeworth," continues Mr. Murphy's letter, "You can drag and drag and deag some more and still have something left to smoke. Put a load of the average cheep pobacco in the pipe and take a buil desenpuffs and there it nothing left but dust.

"Last fall I was over in Detroit and purchased a pound humsder of Edgeworth for just \$1. You people over the border don't realize bow lucky you are!"

1 1 1

MR. MURPHY is not the only one who feels Edgeworth is a bargain at the domestic price. Many find it actually costs less to smoke Edgeworth. They get more smoking hours per tin-and what is more, they are Edgeworth hours-which is the most fragrant, enjoyable thing ever said about pipe tobecco. Larus & Brother Co., Richmond, Va., Tobacconists since 1877.

On your radio, tunn in on WEVA, the Edgeworth Tabacco Sturios, 1710 Kitacycles.

NEW KIT CONTAINS MATERIALS FOR

A Freighter Model



KTT aM-Ocean froughter, 14 in. long

"HIS month we add another low-priced e assertation led to our sense. It contains complete materials for making a 14 in model of an ocean freighter of the famous war-built design known as Hog Islanders. The price is on y 51 50, postpaid anywhere in the United States or Canada

The model is of the full-hall type. Selected some pine is provided in the kit for the bull tion its and other wooden parts, and there is an ample supply of an other necessary raw materials including three bottles of paint A blueprint with full-size drawings accomtwhire he materials

The feet has been especially prepared for the Popular Science Model-of the Month Club,

but is available to other readers on the same terms so one as the supply lasts Some of the Model-of the-Month kets are attendy exhausted, so do not deay an netering Ask for lot M.

The complete test of our k to to as 1 10 Who

STANDARD SHIP MODEL KHIN

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A. Wharmer Ship II as	ader a 10*
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AA. With his life.	
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D. Span & galleon.	
1.4 n	6 450
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brocker shapen	9020
E. Battleship U.5.5	
Texas, 3-ft	6 950
EB. Same with half	life
POWER AND ADDRESS OF THE PARTY	7.45*
O. Elizabethan staller	and a

blocks shaped 7 75° L. Farragut y flag s b p

Rantord a steam and only a professor was 33 to 540 Lills Same with half lists

Signed Q Pro nee Suissaid 1 in hall, with I fts sawed to shape V Chapper Sourcesen a) the Seas Q bull, with lifts sawed to shape. Y. Trading schooner, 171/4 in. bull

28 U.S. Descrover Preston 31 in bull wish lift wood as Considerant Old Ironside-hall with its saved SIMPLIFIED SHIP MODEL KITS

	Advanced to the facility and the contraction of the	
T.	Liner S.S. Menheltan, 12-in-	1.00
H.	Cruiser U.S.S. Indonnepolis, 12-in.	1.50
J.	Clipper whip See Witch, 13-in	1.50
	MODEL-OF THE MONTH KITS	
	have a decrease of experience and the	4 00

M., Aircraft carrier Seretoge, 18-ln...... 1.00 N. Four U.S. destroyers, each 653-in. 35

O. Liner S.S. St. Lents, 11 In............................... 1.00

R. U S. cruiser Tuscologie, 111, In., 100 T U.S.S. Brooktyn, armored cruster in U. Hapawote, the ship in Treasure Ishad 7 n Z. H.M.S. Beauty 11 1.50 tM Show boat illum nates, 14 n 1 50 aM. Ocean freighter, 14 in....... 1 50

MISCELLANEULS

No. 4. Solid muhogany book trough 2.5 in long 9", in. wide and .4 4 in high over all Ready to assemble and sia n included 5 "5"

No. 5. Solid rock maide hanging was rack with one disect of the wide 30 a in high Ready to a semble and stain includes

No. 6. Solid rock maple butterfly table, top 19 to 22 in., height 23 to in. Ready to assemble and stain included......

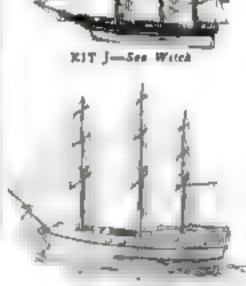
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XIT R. Materials for a water line model of the Tuecalonia







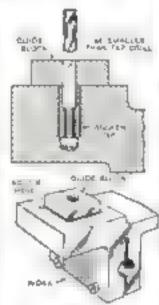
MIT U-Hespanyola of "Treasure Island"

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mail. No kits selling	eder hein, de regjorred i for leis than 14.00 can his offer is stade only in

REMOVING A BROKEN TAP FROM FINISHED WORK

WHEN a small tap breaks off as a model or instrument, it generally remains immovable even after a lot of patient labor Some workers advise the use of a mixture of sulphuric and nitric acid for loosening the piece of broken tap, but this enlarges the threads, and even then the piece of broken tap is hard to fish

Some time ago I inadvertently broke nó-J2 tapina finished bruse custing. First, I heated the custing to annea, the broken tap. While it was cooling. I sembed two lines across the center of a 1/4 by 3/4 by 36 in, block of cold-roued steel extended the lines down the sides of the block, and put a center-punch mark at the intersection of the cross lines. Two lines at right angles were also scribed exactly acrossthe center of the tapped hole. The



A guide block a used in dr.Hing out the cop-

clamped temporarily over the hole and the two sets of scribed lines lined up accurately

The block was next sweated in place with solder and the clamp removed. A drill one sign smaller than the tup drill for the threaded hole was used to drill through the block and right into the center of the broken tap

When the piece of broken tap is reached with the drill, it is necessary to go slowly until past the jagged broken end, and plenty of oil must be used. When the tap has been drilled out, the piece is heated to looses the block, and the hole is retapped with a new tap to clean out the threads.

This is a sure and safe way to remove a broken tap from a piece of work that has strendy gone through a series of tedsous or comparatively expensive machining opera-

HOMA .- CHARLES H. KRUCKTER.

BETTER HE' DLIGHTS FOR MODEL LOCOMOTIVES

WHEN operating a model railroad at night, the broad, spreading beams from an open-bulb beadlight often detract materially from the realism of the model. A ministure headlight that throws a realistic paraliel light beam may easily be constructed with a small view-finder seas taken from so old

box camera or any armiar lens. The headlight socket on the locomotive is reptaced by a metal tube of the same length. but of just the right diameter for the less to ship through. If the inside of the tube is roughened with a course file, the tens may be satisfactorily fastened to the end with coloriesa celluiose cement. A \$4-10, bole is drilled in the end of the locomotive, and the tube is soldered over the bale. The socket for the bulb is transferred to the inside of the locomotive and is soldered in position so that the both filament will be a distance equal to the focal length away from the lens. These small lenses mustly have a focal length of about 14 in., but this may be checked by focusing the sun on a piece of paper and measuring the distance from lens to paper With the builb in this position, the headlight will throw a parallel beam that will restore realism to your raticoed.—HARRY B. FUGE.



BY THE KEENEST ES"IN AMERICA

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the Gallette "Blue Blade" wage its last okeh in the final inspection department where absolute perfecturn is demanded.

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NICHOLSON FILES

MAKING A SMALL ELECTRIC FURNACE

Continued from page 721



Electric fareact corner of author's home workshop. The nichrems furnace is in the background

in a spiral of about seven turns, \(\frac{1}{2} \) in apartenter to tenter. The apper end of the cost is fastetied in the same way. The straight ends are bent outward and upward as shown, and the form with the coil on it is set into the furnace on the cement bottom and in the exact center.

If the work has been done properly, the wire ends will project about 2 in, above the rop of the can. They should be in contact with the outer lining, or as far from the inner form as possible. The form is now ready for molding the inner lining.

Several more or less costly high-temperature molding cements are on the market, but a good soon tute may be made by pulverizing an old fire brick with a hammer on a coment floor and acreening about 2 lb of it through a piece of window acreening, then mixing the acreenings with 1 lb. of dry providered fire day. Some back-yard days are suitable, but many of them will seek to contact with the wires, which are much botter than the heating chamber itself. It is safer, therefore, to buy fire day from a beickyard or a local furnaceman.

The mixed are clay and brick screenings are moistened slowly and knesded until the maxture sticks together if squeezed in the hand, but is not so wet as to emit water if too wet, it will crack when baked. Thin layers of it are then rammed in about the form, but care must be used to keep the cammer away from the wire coils so that they are not displaced. The vertical wire count not be disturbed, and, of course, must not touch any of the turns of the coil. If any of the turns of the coil are accidentally moved into contact with each other, the form and clay must be removed and the molding begun again with the coils in their right place.

When the lause has been morded flush with the top, it may be smoothed with a trowel. The form is then removed, and a Vern. layer of fire clay is removed asto the bottom of the furnace. Any holes or roughnesses left in the surface around the wires should be filled with fire clay, mixed rather wet and pressed in with a putty knife.

The furnace must be dried for several days in a warm room before heat is applied, or steam may form and cause an explosion. After drying it is well to paint the top, but not the inside, with a trul or two of the diluted water glass to harden it.

A cover 43/4 in. in diameter and 3/4 in. thick can be molded of the fire-clay motture

is a tin-can cover or any convenient moid. It should be rammed hard. A 1/2 in round hole may be purched through its center before it is dry, so that it can be easily lifted off the furnace with a bent wire. After drying thoroughly, it should be painted with two or three coats of the direct water glass.

The furnace is now ready to be baked. The two ends of a tocket cord are connected to the two ends of a tocket cord are connected to the two ends of the cold wire. Lap the wires and wind the joints tightly with a fine copper wire. Solder, of course, is useless because of the heat. The plug is serewed into a right socket, the cover placed on the furnace, and it is left to bake for from three to six hours. Clay does not give up all its mousture until it is well above ted heat. Some ateam will be emitted, and the furnace was best slowly the first time. After two or three heats, it may be expected to reach 1,800 deg. in about an hour and a half

No melted metal of any hind or chemical salts should be allowed to touch the resistance coil. The furnace should be set on a couple of bricks or on a coment floor

The temperature can be judged by putting small amounts of various materials into iron pape caps and acting them in the heating chamber. When aluminum melts, the temperature is about 1,210 deg., F. At 1,500 deg., horse melts, at 1,480 deg., table salt. When pure aliver melts, the furnace is at about 1,800 deg. A sliver coto melts at a slightly lower point. Use the last-mentioned test when heating the furnace the first time, and turn off the current when the coin melts. If the hung is very well made, the furnace may go to a higher temperature, but should not be allowed to do so, for the resistance coil is likely to burn out. If a long heat is wanted at a lower temperature, the cover may be left partly or wholly off.

Recause the current used is less than 7 amperes, an ordinary 15-suspece fuse plug

A furnace built as described has been in daily the for more than two years. With a pair of tongs and some fire-clay crucibles that can be bought at a scientific supply store, it is valuable for many purposes. It has been used for melting type metal, white metal, sinc, alumnum, aliver solder, bracing metal, yellow bram, bell metal, speculum metal, and other alloys, as well as for bracing, tempering small tools, working and annealing glass, and taking enumel glazes, homemade crucibles, and pottery. Even synthetic rubies, supphires, and emeralds have been made in this furnace.

Old

WHEN it is necessary to one a deal bedicator on a magnetic churk, fit short brass legs to the base and use a brass top for a contact point.

Liquid rolder, now appliable in small tubes, is useful to hape to your tool box.

A periodical flushing with gasoline and the use of high-grade spindle oil will lengthon the life of a high-speed spindle.

If the proper top size of hole is drilled and sufficient lubricant to mod, a botter result can be had by operating a tapping attackment at high appeal than at low speed.

Many a good die to rained by using it oper too large a hale in the boister plate,

When drills of a cheap grade if it is nec-exactly to use them, can be made to stand up better by heating the paints to a bright red color and dipping them in sulphur before queuching,

If the jows of a pipe wrench ore chro-mium placed, they will last as least three times langer.

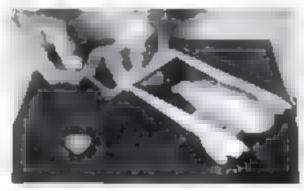
STREAMLINE MODEL

(Continued from page 64)



Betting one of the engine acceltee in place

to painting the assembled model mark the location of windows, ailerons, and other details with a hard penci. The indentations will show through the paint. An attractive color scheme is obtained by pointing the body, nacelles, and vertical talk light green, the wings and horizontal tail yellow, and the windows and tires black.



The tail units are held securely with pins

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Have you over laken the errorg read Have you ever labor the strong road and driven many soles before the extreme your matter. This new Albert A

Complete clock. A start Price let from the rene a network 2" h 3,2" gits or Walle of any Tak Whitepan. Magdy this facuum Mach result would be in the first a Original and Monters to West to the first and American West to him pant side. Tellique was now in a side of the part of the p

Hardwood Panels

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lans of Aircraft Carrier "SARATOGA"



Nother this to the serve of the News. " Make a model for yesteral with the gid of these ency-to-follow plane. Cor Du Fout Duos Coment, then it will last. This arang, trainparent consent is unterprent Baich every. thing except rubber. Send green earton or red disc from 25e tabe for free "Saratogs" place. DU PONT, Dept. A-4, Wilmington, Delawarn.



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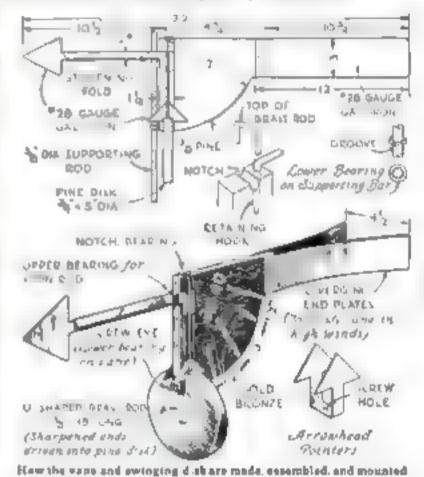
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WEATHER VANE TELLS VELOCITY OF WIND

The calibrated radial lines painted on the vane, which represent the degrees of wind pressure or velocity, may be accurately determined by the simple expedient of holding the body portion of the vane out from a moving automobile. The speed as shown on the speedometer produces a corresponding wind pressure on the moving car and, of course, also on the gravity-controlled, swinging disk of the exposed vane. The degree of swing of the disk may be marked on the vane while the car is moving at predetermined speeds

Any desired type of cross arms with the letters N, S, E, and W may be added, but they should be placed in this case above the vane instead of in the usual position.

In observing the vane during a brisk wind. the extreme degree of swing of the disk gives the approximate velocity, especially when there are suciden puffs .- J D. GARTIKED.



EASILY ASSEMBLED AQUARIUM AERATOR

AN AQUARIUM serator of a simple and inexpensive type can be made as shown in the accompanying diagram. The materials required are two I-qt, bottles; 12 ft. of 1/2 in

as any ordinary weather vane, the one

Everyone wants to know

Although specific dimen-

subber tubing, marked 3; 4 ft of 54-in glass tubing, marked a; two rabber stoppers with two holes in each, to fit the bottles, and either a commercial regulator and release, which cost very little, or a short length of \$6 in round reed, the natural ducts through which will serve as an air release. If the latter is used, it will also be necessary to use a valve to control the volume of

Insert the stoppers in the botties, and cut and bend the glass tubing as shown. Use part of the rubber tubing to connect the two ionger glass tubes in bottles i and 2, and use the remainder to connect one of the shorter class tubes with air release 3. Fill bottie / with water to within of the short glass tube, and put the bottle on top of the aquarum. Set bottle a on the floor, and put the alt release in the tank. Blow into the end of the short tube in bottle / to start a flow of water from bottle r to bottle r. Adjust the air re-

loase to get a very fine stream of bubbles. The finer the stream, the longer the serator will operate without attention.

As the water gradually flows anto bottle a, air is forced into the tank. When the lower bottle is filled, the position of the buttles must be reversed, and the tubing leading to the air presse transferred from one to the other To change the connections takes only a moment and soon can be done almost automatically

The connections and slopper, of course, should be sir-tight. If the release is properly adjusted, air will be supplied for hours without attention. The advantages of this acrator are that it costs little, requires no current to operate, and can be used where there is no convenient outlet for a motor-driven APPRIOR -- ARTHUR E. LANDMAN

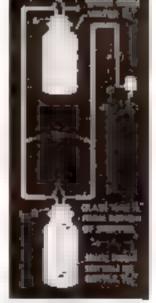


Diagram showing way to set up the bottles

SUCTION-CUP SHOP LAMP MADE FROM ASH TRAY



A ten-cost suto sab tray forms the hody and reflector of this moveher shop light

THIS general utility metion-cup lamp has proved particularly useful around my home workshop. It is made from a ten-tent auto ash tray and has a rubber suction cup attached on the side so that it can be mounted on almost all any tools, even on the underside of the hand-saw table when I am adjusting the saw blade.

Inside is a ministure socket for the small style of 110-volt electric bulb. It is necessary only to pry the rim off the ash tray, drill two holes through the opposite end for the socket bolts and a hole through the side for the cord, and trassemble

The chromium top of the ash tray reflects the light sufficiently. Of course, there is the customary 6-ft, length of lamp cord and plug

There is enough radiation of heat to that the bush will not burn out I also lined the inside of the ask tray with tin, although the light is ample for most purposes without going to that trouble.—Walltin K. Moss.

PLATING INNER SURFACE OF BRASS BOWLS

THERE is so much popular interest in hammered and spun copper or brass howis that it is of value to know how the inside surfaces of such bowls may be easily plated with a low fusion metal such so the or pewter. This type of plating gives a pleasing contrast in color, and at the same time readers the bowls more satisfale for boulou containers. It cannot, however be used to plate an article that contains soft soldered joints.

Remove all tarnish from the surface to be plated by acouring it with steel wool. After the surface is thoroughly cleaned, slightly heat the bowl and amear the inside with paste soldering flux. Then place a few arraps of pure tin or high-grade pewter in the bowl, and continue the heating. As soon as the plating metal melts in the bottom of the container, use a pur of tongs to move the container around in such a manner that the plate will be distributed over the surface. A wooden stick will be useful in pushing the molten metal out to the edge of the bowl. Care should be exercised to avoid tinning the outside of the bowl.

After the surface is completely rovered, throw out the excess metal, and wipe the plated surface while still hot with a clean cloth. This procedure will remove all dirt and any excess material that has remained in the bow! and at the same time give the surface a polished appearance.—George A. Smith.



NEW 1936 model 9\s\" n 2' "Workshop" Lathe with Harisontal Counter Shaft, J(1982 h.p. Reversing Natur, Streeting Switch and Belling as shown (\$18440 Down, \$7.00 a Month for 11 Months)

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New LS40 Lathe

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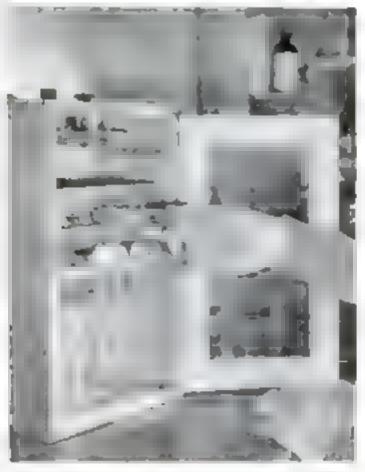
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Hore Briver-Built Tooks Are Made & Sold Than Any Other Make.

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Incubator Cabinet

for Microscope Cultures



Perci diates are kept on movable shelves above test tubes

Defend the most useful pieces of equipment that the arms teur can construct for his microscope laboratory is a small electric incubator o which a constant temperature can be maintained. Then barieria cultures may be kept at the proper temperature for rapid growth, insect eggs may be hatched, and hay infusions and similar cultures of sucroscopic creatures may be kept in a flourishing condition. By readmaining the thermostat, the incubator can also be used as an oven for keeping paraffin want in a molten state while it penetrates speciment being imbedded.

The incubator consists of a wood box with a plan-puncied, hinned door, a lamp bulb for supplying heat, an adjustable thermostat for maintaining a constant temperature, a thermometer for indicating the temperature, and a series of shelves arranged for building heak ers. Petri dishes, and lest tubes. The cost of materials for the incubator shown was less than three donars.

The design and dimensions of such an inrulator can, of cruise be varied to suit individual needs. That illustrated is of 1/2-to, redwood, which is an easily worked wood with good hear-insulating qualities. Although a single glass panel was found satisfactory in the doot, a double one would

reduce the heat loss.

Outside dimensions of the box are Height. 15 in., width, 0½ in.; depth, 7½ in. The height is the mine as that of the ordinary standard microscope cabinet which was to share the laboratory table with it. The door is made of 2 by 1½ in.

strips, rabbeted along

the inside edges to re-

cove the glass, which is held in place with wood strips. Use casein glue, which is odorless, in all joints. Three small brass bloges and a small brass knob are required. The catch consists of a roundheaded brass had in the edge of the door when the door is shut, this presses against a strip of this metal bent so as to form a springy socket

The thermostat is built around a I-in ether-wafer unit originally intended for a poultry incubator, purchased for 35 cents. A larger, double wafer is available for \$5 cents, but is too busky for an incubator of this time. The amonwater has a threaded pin projecting from the center of one surface, and a bollow-end stud from the center of the opposite surface. When the wafer is warmed, the ether vapor thatde it expands, forcing the sides apart like the bellows of an accordon, Cooling causes the disk to contract. The amount of expanwon or contraction is proportional to the temperature.

The disk is supported on a 3 by 4 in piece of bakelite composition or other insulating material (even wood, if of a kind that will not warp noticeably). If you use a hard composition, you can drill holes and thread them to receive

a-12 machine screws so that the use of many be avoided. Mount the disk on a strip of metal about 1 in longer than its diameter by inserting the threaded stud through a hole and clamping it with a nut, and screw the strip to the square base as shown. Place washers or short (Continued on page 87)





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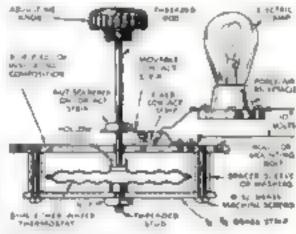


INCUBATOR CABINET

(Contouned from page 80)

metal tubes under the ends of the strip so that the hollow stud of the thermostat wafer is about 1/4 in from the surface of the base piece. Drill a 16-in, hole opposite the end of this stad. Also drill and thread mounting holes at each corner of the base.

On the opposite side of the base piece mount two contact strips. The function of these is to break the electric lamp circuit when the water pushes against one of them, or connect the hump when the wafer contracts and lets the contacts come together Excellent contact strips can be obtained by tearing apart an old telephone Jack, such as you can pick up at a radio repair store or other place where junked radio equipment is available. These strips are provided already with contacts that produce a minimum of sparking. Platten the end of the longer strip if it is bent, drill a hole near that end,



D agram showing how thermostat is arranged. The other water unit expands when bested

and solder over it a 6-12 nut. By means of the two boles a ready in the strip near the opposite end, fasten the mere to the insular ing base so that the nut is directly opposite the hollow stud on the thermostal disk. Arrange the other contact strip so that its contart point ites chreet y beneath that of the first strip Run a bost through the soldered not and turn it down until it preses against the bottom of the hole in the thermostat disk stud. This bolt should be long enough to project through the sop of the incubator cabinet and receive an insulated radio knob-

Heating the ether wafer causes the disk to expand and the hollow-end stud to move outward. This stud presses against the endof the bolt, causing the movable contact strip to bend ou ward and break the contact This turns of the lamp Loss of heat through the wasts of the box causes the temperature to drop, the thermostat wafer to convact and the contact points to come together again. The lamp aghls, the disk expands, and breaks the circuit when the predeterm ned temperature has been reached. When the thermostal is working properly under normal room temperature conditions, the lamp will flash on and off every few seconds. An old fashinged carbon filament bub, although nefficient as a light producer, is perhaps a better source of heat than a modern pasfilled lamp. To make the thermostat break the circuit at a higher temperature, loosen the adjusting screw, at a lower temperature, turn it cinclesses.

The lamp is held in a porcelain sorket mounted on the floor of the box, in a rear corner. If desired, an asbestos shield can be placed over the wood near the lamp. The thermostal is mounted at the top, to the rear, and on the side opposite the socket. One wire from the source of current goes directly to the lamp, the other goes to one of the thermostat contact strips, and a wire runs from the other (Continued on page 66.)

HAVING PISTON TROUBLE?

Fitted into the cylinder-hore is a telatively simple looking assembly of piston, person rings, putton pers, and the connecting-rod which is joined to the crank-shaft.

The primary service of the piston is to convert the pressure of the exploding gasoline on its upper, or closed face, into the force necessary for turning the crank-shaft. The downward escape of the gases is checked by the flexible rings and by the film of lubri-Cating oil between piston and cylinder,

That oil film also must resur the terrific heat playing upon the pitton as well as custom the shock of the adevise thruse of the down-swinging putton and connecting-rod. Any weakness to the oil film inevitably leads to premuturely worn rings, scored cylinders, loose partons. This condition in turn leads to sapid formation of curbon.

If you wish to evoid piston trouble and have assurance of perfect functroning of the motor, the selection of the right grade and quality of motor oil is essential. The fact that ring replacement and carbon removal are among the commonest repair jobs indicates that the motoring public is paying a large price for its lack of dis-Commation between motor rils.

The first choice" of seasoned motorista ia Quaker State Motor Oil. For over 20 years Quaker State has been demonstrating its lubricating effitiency and the value of the "extra quart of lubrication in every gallon," laght-end, meless portrous-found in ordinary oil-are removed at the rehnery. You get four full quarts per gallon of rich, pure lubricant which will stand up against the hardest draving and assure freedom from reputs due to faulty or insufficient ubrication.

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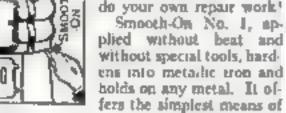
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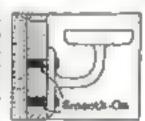
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INCUBATOR CABINET

Continued from page 871



The thermostal water is mounted on a metalstrip, which is then fastened to the panel

stop to the remaining lamp terminal

Shelves are made of this plywood or simhar material and are held by slender street named across the sales of the box. Hores are bored in the lower shelves, as shown, to hold test tubes, while the upper shelves are plain None of the theives should extend to the rear of the box or be more than about 4 in. wide. This leaves a space at the rear for air circulation. The strips forming the door stops separate the front edges of the shelves from the door sufficiently to permit circulation at the Irust Narrow strips tacked or glued along the year edges of the shelves act as stops to prevent Petri dishes from being pushed back too far

The temperature of the incubator illustrated varies loss than a degree, even with the door open. If you intend to use it for highly exacting work, it might be well to take temperature readings at several points in the interior attraitaneously, and make any necessary adjustments of heat distribution by inserting baffles or abselds, or by rearranging the thermostat and lamp. There will generally be a slight variation in temperature from bottom to top because of the natural rise of heated air, but for all practical purposes this can be ignored. When putting the incubator into operation and after adjusting the thermostat, allow about fifteen minutes for the temperature to become stable.-- M. C. W.

PERFORATED PATTERNS MADE ON A SEWING MACHINE

STENCILS for marking outlines on signs, fretwork, and the like can be made by drawing patterns on light paper and then perforating the lines with a sewing-machine needle. The steneti is placed directly on the work, and the design transferred by applying chalk through the perforations or using a pounce.-- ORVILLE KILLMAN

TESTING COLD-ROLLED STEEL

Sourz cold-rolled steel-perhaps the assjointy of that picked up by amateur mechanges in the junk yard-has hard spots in it. These will cause any lathe tool to chat ter, no matter how carefully ground and set It is therefore an excellent plan to test any piece of stock intended to be finished to close limits, by taking a light cut off the outside of the ent re length. This will usually reveal any hard spots before a lot of time and work have been wasted -- M A COOPER



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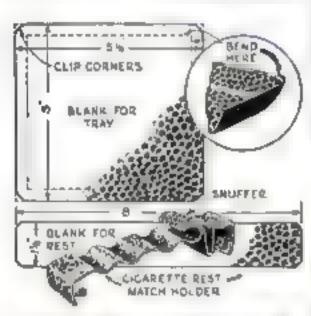
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ASH TRAY IS BRIDGED BY CIGARETTE REST



*OUNTLESS designs for ash trays have Chem published, but here is a new and different one that has two distinct advantages. The eigerette rest is placed over the truy in such a way that neither the eshes nor the eigerette itself can possibly full on the table. There is also a snuffer into which a cigarette may be slipped to just it out. The aext eighrette pushed into the sauffer forces the old one out so that it falls into the tray

From 10-gauge sheet copper, cut out the blank and clip the corners as shown. Anness by heating to a cherry red. After cooling shape it at far at possible by hammering on the inside, bending the sides up to form a hoxlike tray, It is then best to use a square, hardwood block in the vise to finish the shaping. Place the tray over one corner of the block and hammer (Consensed on page 90)



The blanks for the two parts and how they are best before being riveted or seldered



The shaping of the tray is finished by hammering it over a berewood block in the vise



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NOVEL COPPER ASH TRAY

(Continued from page 89)

in the sades and corners in the way shown until all are smooth. If the material becomes too hard, repeat the annealing.

The cigarette rest is cut a little longer than shown, as the surplus may be removed after the shaping is completed. This piece also should be very soft. Double the metal tightly 334 in from one end, then form the muffer around a 34-in. rod. The remainder of the short end forms the match bolder and is shaped with pliers. It will bold either box or book matches. The cigarette rests are all formed over the 16-in, rod, and the balance of the shaping is done with the piters

Drill two holes in each end, and corresponding holes in the sides of the tray Rivet. the parts with escutcheon pint, unless you

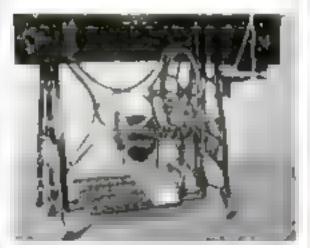
prefer to solder the piece

Dissolve a small piece of liver of sulphur in about a quart of water, then, after washing the tray thoroughly with soap and water, immerse it in the solution and leave until it turns brown. Remove and wash it, polish well, and apply lacquer - Dieg Hutchiston

What types of decorative metal work are you especially interested in? Send a past card to the Bame Workshap Department listing any projects you wish published in future issues.

FAN MOTOR RUNS OLD SEWING MACHINE

HOW I utilized a fan-motor to drive a foot-power sewing machine is illustrated in the accompanying photograph. I removed the guards and fan from a two-speed 12-in. fan and put on a small grooved pulley, obtained from the dealer who sold me the fan. Then I took the motor off its base and set the lower neck part into a tapered hole in a short piece of "two by six." This was bolted to the top of the sewing markine treadle with a light brace to the top of the motor to hold



An emergency method of using a fan motor to drive an old-style loot-power sewing machine

it from twisting. Next I removed the treadle rod or pitman, clamped a grooved wooden pulley below the sewing machine belt wheel, and lengthened the belt so that it would go down over the lower pulley, as shown. The two-speed switch was removed from the base of the motor and installed under the righthand machine drawer. The spring at the rear parmally holds the motor pulley just clear of the best

To operate, the switch is turned to high or low speed as best suits the work, and the treadle pushed down at the coar until the pulley on the motor is held firmly against the belt.-I W DICKERSON

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HOW TO MARK GRADES ON PHOTO-PAPER PACKAGES



Writer several packages of photographic printing papers are opened for use at one time, as when negatives of varying degrees of contrast are to be printed, there is danger of missing up the packages because the inner black envelopes are not marked in any way to identify them. This often causes confusion.

Upon opening the outside mickages, mark the respective grades of contrast upon the inner black envelopes with a white procil such as it sold by stationers for writing on the black pages of photo albums. This will unmistalably scientify the various packages, even in a weak safe light.—C. Ecwano Liverence.

PLACING WHITE TITLES ON PHOTO PRINTS

Trings or other information may be written on prints with a clean steel pen and a saturated solution of potassium bichromate. In this process, the writing upon the print becomes a part of the regular printing procedure, and the bichromate is not effective upon prints that have been already developed

Set the negative in the printing frame is the regular manner. Temporarily locate the secutived printing paper to get an accurate idea as to just where you descre the writing to be, taking care to avoid extreme high-light locations. Then remove the paper and write the deared inscription upon the sensitive side of the paper. Blotting paper can be used to hasten the drying. Let the paper stand a minute or two to insure that the writing is dry. Then print and develop in the regular manner. The written inscription will appear a crisp white.

In case many prints are made from the same negative, it is advisable to place a sheet of clean transparent tribulese between the perative and printing paper to avoid the penability that say damp behromate solution will be deposited upon the negative and show on the next print.—Dantas, J. Egapt

PULLING LEAD-COVERED CABLES

Executives, workers are warned so often agazest the use of oils and greases as lubricants in pulling wire that they often lose sight of the fact that grease can be used to great advantage in pulling lead-covered cables into conduit Henry cup grease can be generously applied to lead cables without damage to the cable, and it greatly leadens the effort required in pulling.—I., N. G.

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PLANS FOR BUILDING A HAND LOOM

(Continued from suge 67)

the photographs, assembly drawings, and detan drawanes. It is, therefore, quite similar to make comparisons and clear up any difficulties as the work progresses

The wood used for the foom illustrated was buth Maple may be used. A let of materials is given below to aid in purchasing. The iron parts, with the exception of the pawl, are tastings, and wooden patterns must be made either by the builder of the Joom or by a partern maker in the foundry where they are to be cast. The pawl may be made by a local blacksmith

The frame of the loom is mortised and tenoned ingether. Each side is assembled with permanent joints, (Continued on Juge 93)

List of Materials for Four-Treadle Hand Loom

A f pc 11 " m I 15" x 4015" H 2 pc 3," x 5" x 60" (1 fc 5'2" x 134" x 46 " E) 1 ," x 1 ," x 4015" E x (c 1 " x 3'3" x 44" Raddle 1 pc 1 " T m 2" x Cast from full rum 2 rest d se detail) 6 4 pt. 1 t. " n 40" T. 2 c. 113" x 152" x 1" U. 1 pt. 332" dears n 45 5" Cloth beam. 1 pt. 3" diam. 1 46 V 1 pc 1 7 1 5 dlam. W 1 pc 1 7 1 6 diam X (7 x) 5 2 3 7 V 1 pc 1 7 1 1 7 x 15" Z. Reeds One Hident reed 40" long and one 14 dent reed 40° long Down at 1° and 12° Ratchet wheel cast don I red d see detail, Fig. 23) drilled and counter-Junk. l'aul, neought iron, I req'd (see de tail Fig. 24. Rack terth, cast fron, 2 req d (see detail Fig. 201 Carriage boits, 4 respl. 44" x 6" Canvas 1 1 6 yds 40" - ide Small metal place dedled and countersunk for acteurs say Fig. . Wife time a read ther detail hig ? Shutties 3 or more read tree detail. Fre 25 The stock for these 5 3 16" x 1" x 17" Canvas +10 ks. " pc. "1" x 1" x 40" see high 0 and 30 Cotton twine I had "" dum Serest pulleys 2 read, wheels 2" dam tere E ps 4 and 5) Anning pulleys, 4 repd 1" single Awaring pulleys. 4 req'd, 2" double Screw eyes, 32 req'd, 16" eye Heddles, 1 200 (300 to each beddle Irue butt hinges. 4 req d, 2" x 2 ," with leaves opened. Handies for ratchet wheel, 2 pc. +2"



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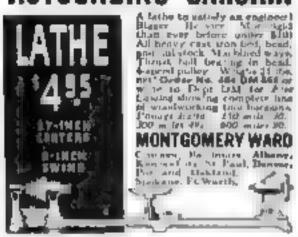
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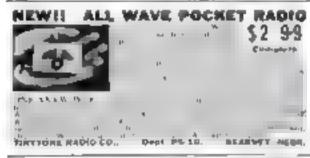


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PLANS FOR BUILDING A HAND LOOM

(Continued from page 92)



Fig. L. View showing loom from the rear

but the cross stretchers G and P and the cloth and warp beams are removable. This is a neccoary form of construction, because the loom is too wide to go through an ordinary doorway without being taken ajurt.

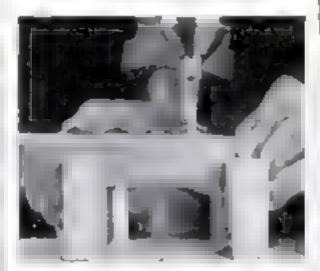
The cord used in the harness is a strong, (wested cotton twine, about a in, in diameter

The raddle, shown in Fig. 11, is a contrivance used in place of the breast beam when threading up the foom to regulate and space the threads as they are being rolled on the warp beam.

The rack teeth permit the bester frame to be moved back to suit the convenience of the operator as the cloth is being woven

The cost of the materials for this beht, effiment loom was about \$30, including wood, pulleys, canvos, and castings.

ORNAMENTAL SPIRALS CUT ON DRILL PRESS

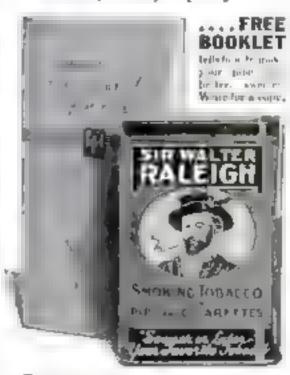


Lanca wood dowels, curtain poles, and other tods can be routed on the drill press to give a from spiral effect for decorative purposes. The illustration shows the rig, or cradle, for holding the poles steady. A wood pin set in the baseboard engages the routed spiral after the first inch has been made by means of a pentiled layout, and thereafter it is necessary only to turn and push the pole until it has been routed for its entire length. So that the pinwill engage the routing as soon as possible, the rig should be adjusted to right or left as it . necessary. It is then held on the drill-press table with C clamps. When a number of rods are to be prepared, the end of one can be temporumy fastened to the next so as to eliminate laving out the starting point on all but the Arst pole.—EDWARD V BY ENHAM.



F the sour notes of that strwy old I pipe make you gasp and gag, remind the smoker that pipes-like planos - have got to be kept tuned. Let him scrape out the bowl, ream out the stem, fill up with Sir Walter Raleigh Smoking Tobacco, and the pleasant aroma of clean Kentucky Burleys will fill the air, By hard work (and a little luck) we've found a blend that is noticeably milder to the tongue and sweet spusic to the none, It's kept fresh in heavy gold foil. Try a tin and sing for joy.

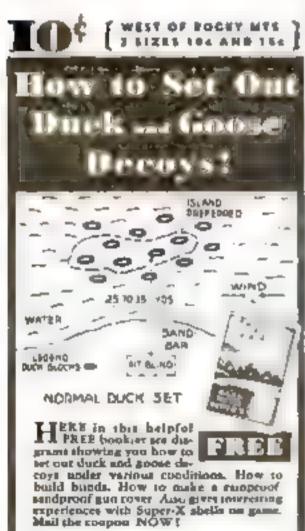
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MICROSCOPIC PLANTS OFFER RARE BEAUTIES

(Continued to me page 45

largely to the presence of impresoned, colored a. Le which were growing at one time in the waters of the springs even though those waters were hot. Some of the plants live in water at 135 to 170 degrees Fahrenbeit, others exist in snow and net

Whatever the visitue color of the algal cellthere is alway present the familiar precothe staphal. This material plays an immortan-County not completely understood part with the aid of suntight in the conversion of raw materials such as water and carbon dioxide into food for the cell.

IF YOU find, in a stagment pool, on a tree trunk, or wherever there is mosture, some blue-green algae, you can try an interesting experiment that will prove that the plant is, at heart, green to color Fill a test tube half full of water, and into it introduce severadrops of chlocoform. Shake the tube vicor ously, to mix the two liquids. Then let it stand until the chiocoform settles to the bottom. Carefully pour off most of the water and into it place a quantity of the blue-green

The chloroform-water extracts the blue coloring matter, called phytocyanin, leaving the algae bright-green in color Instead of chloroform waler will can use water to which a few drops of artion be-alphade has been adiled. In trying this experiment, examine the algae with the intermediate before extracting the columns matter and again after it has Leen entracted

Let's return for a moment to some of the perimens collected on the field expedition Here is that bright-green substance taken. with the glass dipping tube, from the bottom of the mook along the creek

Under the inscreacope the long, green fibers become chains of cylindrical, smooth-walled cells whose contents are most striking in appearance. Particularly toward the rounded ends of the strands is the formation distinct The cells seem to be filled with sparal chains of green beath. This appearance is caused by the shape of the brilliant green chromatophases through which are scattered the bead the pyrenoids. This plant is the well-known System and

I se mass of through he assure pathered from the lake is seen to be a constant of several of fferent lands, an armoing in it no filament Some have cells in which the chromatophores are arranged like delicate nets. In others, the green material is collected in a compact mass near the cell center to still others, each cell resotates a pair of star-shaped chromato phores, with a bend (pyrenoid) in the center of each star

HE green mat obtained from the tropicalfish lank seems to be made up almost enturely of Pithophora kewemin. The normal cells are shaped like long cylinders, with the green naterial strong through them like shapeless neta. Here and there can be seen dense, swollen reils. These are the resting spores or alunctes

This examination of easily found aleae could go on for a long time, for a whole life tone, before all members of the vast family became familiar hou can find algae growing in almost every imaginable shape—blamente beadlike strings of cells; ness made of long. siender cells joined together to resemble thicken wire, stars, crescents, spirals, they balls spiny balls, complex balls made up of many cells such as Volvox, and so on and or

There is, however one specimen bottle we must investigate more closely. It contains some of the moddy water collected from the creek where the expedition stopped first The magic lenses of the microscope convert a little, muddy smear, it on many on gate you



h least, a little for the last of the last Standard Lauge to un-

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MICROSCOPIC PLANTS OFFER RARE BEAUTIES

(Continued from sage p.)

made by placing on a slide a bit of the mudthat settled to the bottom of the bottle, into an amazing collection of tiny objects, Prominent among them are minute green forms of most anusual beauty, which travel about with somewhat exertic movements. Plant or anima.? Like plants they are green, yet they move like animais.

Again to the botany book, to verify a suspition Yes, they are fairy plants-diatoms. And here, again, the plant explorer is upagainst a kingdom so vast that a lifetime would be required to master it. There are microscopists who specialize in distoms and spend all their lives studying them, without ever seeing many of the forms that exist

ICROSCOPISTS, especially when their experience is not extensive, frequently confuse diatoms and their brothers, the desmids, for they are in many respects similar The describe are mostly one-celled plants that float about in fresh-water ponds or collect on margins and bottoms. They are beautiful to shape, and their cellulose surfaces frequently are figured with spines, dots, and stripes. One characteristic of a descuid, and one that being in identifying it, is its symmetry, In other words, it consists of two halves, one of which is like a mirror image of the other. Between these two halves, there is usually a constricted zone containing the nucleus.

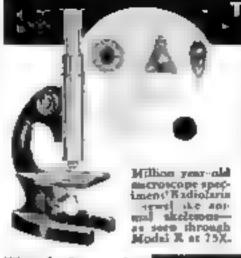
The diatoms, essentially like the describe in that they are one-celled plants with highly sculptured walls, are also symmetrical, but their symmetry is not always of the mir ror-image type. In the diatom, nature reaches an amazingly high degree of delicacy in the matter of sculptured design. The cellulose walls of the distors cell are so heavily infiltrated with silica, or natural glass, that they are rendered virtually everlasting. These sales. skeletora frequently are most beautifully dec-orated with raised ribs, sunken pits, pores, slits, and mouse patterns

You can find distome in almost any pond, stream, lake, or even a readside ditch that has had water in it for several days. They usually collect on the bottom, so that, by straping of a bit of the top layer of sait, you can obtain hundreds of specimens, Farther down, if the pond is an old one, you can find deposits containing nothing but the silica skeletons of diatons. In some parts of the earth are beds of diatomacrous earth that is used commercially for polishing various materials. Some toothpaster and powders contain diatom skeletons millions of years old

The living distors usually exists as an isolated cell but sometimes is joined with others to form a filament. It is a typical one-celled plant brownish-yellow with thromatophores, and has, of course, a nucleus. Movement is accomplished by waving, harrisks citia which project through the openings in the glass skeletons

IF YOU wish to preserve such diatom shele-tons, which to the microscopist are the most steresting parts of these enchanting plants, it is not a difficult matter to remove the cell contents. Simply place the diatoms in a test tube containing a little strong natric acid, heat the liquid and allow it to boil for a time, being careful not to get the hot acid on your skin or cluthing. Then carefully pour off the arid after the solid particles have settled, and wash the silica skeletons thoroughly, Dry them by heating gently, and mount under a cover glass.

Some workers like to have the skeletons mounted in air rather than in balsam. This can be done by making a cell on the stide. reating the bottom with a very thin layer of halsam, and letting (Continued on sage og)



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PEPS UP THE HOTEL BUSINESS

LITTLE over two years ago, while A on my way to the West Coast to cover a series of spot news assignments. I changed trains at Chicago and slipped down into lamois to have a chat with Fred Winters, an old school chum I hadn t seen in years

When I last visited Fred in 1928 he and his wife were happily ensconced in a small

cottage just outside the town.

Coming down on the train I looked forward to a bappy repetition of my last viol but my hopes were saury shattered. Fred. I learned no longer owned the cuttage-the sheriff did-and Fred the freespending successful Fred I had known, was existing upon the goodness of the local community chest and whatever odd jobs he could command

It didn't take Fred long to describe his sudden fall. The engineering firm with which he had been employed was, like many of its kind forced to retrench soon atter the crash in 29. They honestly didn I want to use a man as good as Fird, but depression was depression and even at that, they gave him a bonus, plus his month's salary.

Back at the hotel I thought about Fred's predicament. He was the executive type, a bard-worker and chockful of ideas and that gave me an idea.

I rang for house service and arranged a talk with the hotel manager. Two minutes rater I was in his office.

"Yes I know Winters," said the manager file often came here for dinner Could you use a man like him?" I

asked.

Well ... " the manager hesitated.
"Wet?" I prodded.

Yes if he were acquainted with hotel business," he said, "but I couldn't agree on any salary until he proved he was worth something. . . ."

Exactly," I replied.

The next day I had a long talk with Fred and his wife

It wasn't that the job was worth much. It was merely the fact that here, at last Fred was offered an opportunity to show what he could do

But what do I know about hotels?" he profested.

That's the point," I said.

That night Fred and I went to the telegraph office and sent off the first payment on a borne study course in botel management

The next morning he reported to the hotel manager and began work WITH-OUT PAY The manager agreed however, to place Fred on the payroll the moment he showed what he could do and meanwhile, he offered Fred a small suite and meals for his services.

It was a gambling chance . . . but Fred had ideas, a capacity for management and





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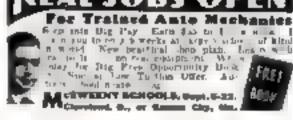
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with an old-fashioned botel to work on, an opportunity

Three months fater I received a letter

from Fred's wife, Helen

I'm writing this because Fred is too busy to One month after he completed the management course he landed a big piece of publicity for the hotel in the local paper . . . He has cut operating costs and now he has just argued the owner into rigging up a sidewalk service with a canopy . . . This ail thanks to you and . . . the course."

Helen didn't owe me any thanks, neither did Fred It was just a case of bringing new life into a slightly antiquated hotel when shown how by someone who knew bow the modern hostelry should be

managed.—J. C., Astoria, N. Y.

AIRPLANE PHOTOGRAPHY SPECIALIST

OMPLETE success doesn't come very early, but twenty-year old Robert Hare, Los Angeles, Calif has at least found a way to earn his collegs money and a profession to follow after graduation.

Robert became interested in photography several years ago as a hobby, and as airplanes had always fascinated him when a youngster, they naturally became the subject for most of his photographs.

In school be studied journalism and decided to make writing his life career. But airtilane photography still remained his chief interest and in conjunction with the many pictures he took, a collection of World War airplane photos was begun. To obtain many of these pictures he began corresponding with a number of famous was time flyers in Germany Great Britain, France. Australia, and the United States. In exchange for their photos Robert would send them shots of the latest American planes.

You perhaps wonder how this could turn into anything profitable. But Robert next began to write airplane feature stories for a model airplane magazine. To successfully sell these stories it was necessary. to colorfully illustrate them with interest-

ing photographs.

To illustrate the war stories he had the pictures the veteran pilots had sent him. But for the stories about modern aircraft he found be must make his photographs vivid and stand out. In order to do so be spent all his spare time studying photography courses. It was easy enough to take just snapshots, but to take pictures with news value and contrast, such as magazine editors wanted, was not so simple. The only way was to follow instructions of those who were authorities at the game

Since he has learned to take newsy pretures he has soid a number of illustrated aeronautical articles to magazines and has made several hundred dollars in this work in little over a year. He recently sold some photos of commercial aircraft to an English magazine

During the National Air Races in Lor Angeles he took over seventy-five photos. Many of them be did not print but all the negatives are arranged in a file for some

Secrets of Success Are You STILL in the DEPRESSION??

TIMES are better. Business is out of the rut-well ahead of a year ago. Millions of men have gone back to work. There's more money in lots of pay envelopes. But what good is that to you, if your pay check is still written in depression

You weren't so discontented a year ago. In fact, you considered yourself lucky to have a

job. But now-you have begun to wonder and worry why the oncoming tide of prosperity basn't reached you yet. The situation is getting desperate, Bills continue to pile up. You can't get along forever on a "shoe string" budget. You must was back those pay cuts. Other men are doing it-how can you?

Certainly, you can't work any harder than you have been. And it un't a question of your intelligence, honorty or ambition. Those virtues do not solve today's problem—they are often insufscient to hold down a job, as millions unemployed sadly testuly.

But there is a way to get back to the prosperity pay check. A way that's probably far easier than you have dreamed. A plan that has been "depresson-terred."

During the worst period of the depression, this plan was helping thousands of men and women forge ahead. Today, during recovery, these same men and women-their ranks swelled by thousands more—are being picked for top positions. They are escaping years of monotonous, toutine service—schieving their dreams while they are young enough to enjoy success in its fullest measure,



Since this plan brings results in had times as well as good, it obviously works independently of business conditions. As unbelievable as that may sound, remember that success is largely up to the individual. Most men struggle through a depression all their lives. The few who forge ahead nde to success the same business tides that sweep the majority to failure.

The LaSalle Success-Building Plan is made for men like you-men with courage, ambition, persistence, who need expert guidance to make the most of their effores. But LaSalla supplies even more than that. Not only individualized training and coaching to help you meet today's crying needs . . . but also the very steps you need to take to fill the job ahead, and force that pay rosso quickly. Any synomic of this plan we could give here, would give you only an idea of this perviou. We suggest you mail the coupon for complete details on your own line of work.

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There's real danger to accepting "depression pay" these days. A danger that lower wages will continue to dog youfor no employer will pay more until he er convenced you are worth more. Some day, some way, you've got to convince him. There's no time to lose. The sooner you begin, the better.

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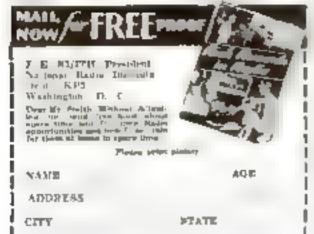
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of these be can immediately make the print and deliver it.

Robert believes in spending part of the money he makes in buying the latest equipment he can afford, and has purchased a new camera with very fast lenses which takes inexpensive small pictures.

Besides the air photos he has also taken some shots of college scenes which he has sold to several college publications -P B., Los Angeles, Calif

NEW CASH PRIZE OFFER

for every letter we print on the subject, "What Hame Study Has Meant to Me."

During the past few months, Secrets of Success has published numerous sturies of men who have achieved places of importance in business and industry because they planned their careers and prepared themselves for advancement by spare-time study at home. We know that among the readers of POPULAR SCIENCE MONTHLY there are many other men whose accomplishments are just as interesting, just as inspiring, and for the same reasons

If you have "arrived," write and tell us about it; not just for the prize alone but that your success may spur on some one else to bigger and better things. As stated above we will pay \$5 in cash for every such letter we publish, but if preferred, the winners may elect to take a 4-year subscription to Popular Science Monthly instead.

Only letters from bonabde home study school students will be considered and these must contain the name of the school and the name of the company, or comparties, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of positions you have held. Your own identity will be kept anonymous, if desired

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(Continued from Juge 05)

it dry Scatter the diatoms over it, warm the slide gently to make the bassam tacky enough to cause the specimens to adhere, and then apply the cover glass. Special mounting materials for diatoms are available.

There has been developed, in Germany, an embedding material intended to make algae easier to examine with the microscope. The usual mounting medium for microscopic objects is transparent, Canada balsam being an example. This new algae-embedding material. however, is black in color, The specimen to be mounted is first fixed and completely delaydrated by the usual methods. Then R is urranged on a clean stide, a drop of the embedding material added, and the cover glass present in place in such a manner that all the her bubbles are excluded. The glass is pressed down ones the specimen rests against both cover and ande

WHEN the slide is examined, the dark-col-ored mounting medium reduces the amount of ight that otherwise would past growed the aleae, but lets aght from the microsome moreor pass through it. The result is a surprising a distinct image in which detail oth era se avasone a seen trearly. The mounting material is also being used for other objects, but h as wood filters.

For permanent mounting, algae must be fixed and generally, dehydrated A mutable fix ng agent in weak chrome-acetic acid solution, made up to follows: one-percent tolution of chromic acid, twenty-five to one percent solution of scatte acid, ten ce; dis-I led water sixty-five cr. An ordinary eightoutice strinking glass contains approximately 240 cubic contimeters.

Leave the specimens in this fixer for two to twel a hours or somer if they will stand it Next, wash the roughly in running water. An easy way to do this is to put the fixed algae wto a tall glass tumbler, the over it a piece of thresectoth, punch a small hole in the cloth near the edge, and insert a glass tube connected to the water supply. Water entering through the tube escapes over the tumbler edges, the cloth holding the algae back. It is best to wash the specimens for several hours

After this, they can be ituned and mounted this veems of debydrated by leaving them for an hour in 6 cen percent sirohol, a semiar Lime in twenty-five-percent alcohol, and for at out two hours successively in thirty fiveprompt. The process and execute person do cohol. For inue o e preservation in alcohol, an eighty-five-percent solution can be used-Final dehydration is done by leaving the material several hours to minery five-percent alcohol for owed by thirty minutes to an houra absolute alcohol. They are then mounted in balsam or the special, dark-rotored algae-embedding medium.

All THOUGH alone are of great interest to the microscopist and the botanish, from a commercial standpoint they are not exceptionally variable. Diatomaceous earth or lucseiguhe is used for scouring and polishing. Some marine forms of algue, such as the kelps whose strands reach 700 feet in length, are sources of (od ne and agar agar, the latter used in certain medical preparat ins. h making Oriental soups and leibes, and for growing bacteria.

On the whole, you will find the langdom of fairy plants one of the most fascinating in which you can browse with your encrescope. You can learn much shout all plant life by studying these simple forms. You can get lessons in beauty such as you will find in no other way Doubtless many designers already have discovered and been inspired by this store of beauty hidden from the naked eye.



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Lifting Stunts



About 1 lb of No. 18 double cotton-covered wire will be required. This may be wound on a wooden form and afterwards wrapped with tape (see P. S.M., June '34, p. 80) or on a copper or brase form made as shown. A un or sheet iron form cannot be used. If the metal form is used, the completely wound form is slipped in place over the core. The ends of the coll are brought through the holes dried on each ade of the terminal strip-These holes must be smulated with aber tubing

A brass or copper retaining plate with a hole cut out for the care is pressed into the magnet shell to hold the coll in place,

To obtain the greatest efficiency from the magnet, an armai are plate should be made as shown. Its surface

should be perfectly smooth and true so that it was make good contact with the magnet.

If the magnet shell were made of cast steel, r would support a weight of 500 lb since the nearmets, qualities of cost steet are greater than those of wrought from Unit from a the

The magnet marked No. 1 is easier to make but somewhat less ethinent. When the nected voto two dry cess it w support 50 lb on a current consumption of 4 amperes.

Rend a pacce of \$5-in. soft from red, 7 in long, to the shape shown, and drill a hole for the supporting book. It is advisable to heat the fron before bending. If \$5-in, from is not available, a slightly larger or smaller size may be substituted if the holes in the end washers are changed accordingly

Place four invalating washers on the iron

STUNT that never fails to bring gasps of wonder from the layman is to connect a ungle pencil flash-light cell to a powerful homemade electromagnet and have it support the weight of two boys or men. Actually, the magnet will have the same lifting power and consume the amount of current cerardien of the sate of the dry cell, but the uninformed will usually associate a minute amount of electricity with a cell of such result propurtions. The cell, of course, should be respected to the magnet only when actually in

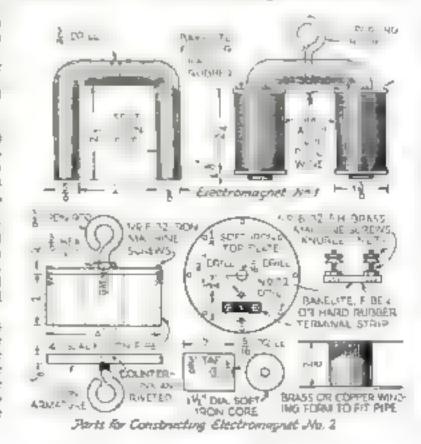
the magnet macked No. 3 in the drawings is expable of sustaining 250 lb. on a single flash-light cell. The current consumption is .6

The shell in 4-in, black from pape, turned to a length of 2 in, in a lathe. It is essential that

the ends be turned perfectly true A we might or soft from plate 4 is thick and 4 a in thi diameter is drilled as shown and corresponding holes are drifted up one end of the pape to which the idate is fastened with machine screws

The core is a piece of soft iron. Jurned to size drilled, and tapped as indicated. This is fastened to the top plate with an evelolt, which is made from a piece of by in round grob, threaded on one end. The assembled magnet shell is now placed in the lathe and the end of the core faced off true with the edge of the pape. If deared the whole magnet shell may be turned from one solid piece of wrought trop.

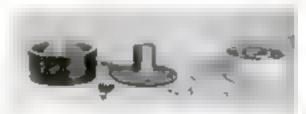
A fiber terminal strip, as shown in the detail, is made and fastened to the top plate with a machine screw. The binding screws should be counterwale into the stop so that they will not touch the top plate





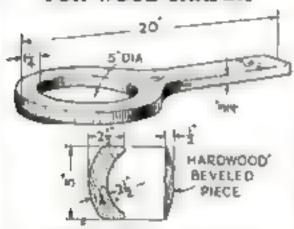
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core, and wind six layers of No. to double cotton-covered wire on each leg. Wind each coil in the same direction and connect the inside wires. An alternate method of winding would be to wind each coil in the opposite direction and connect an inside and an outside wire, but the former provides a never connection. The wires should be brought through small holes dedled in the insulating washers. Pleasible lends connected to the ends of the coils will greatly facilitate the use of the magnet and lessen the possibility of the reads breaking off where they come through the washers.



The parts used in the magnet marked No. 3

GUARD AND HOLD-DOWN FOR WOOD SHAPER



The guard is asked from heavy plywood and has a bevelop b ock glued underseast in front

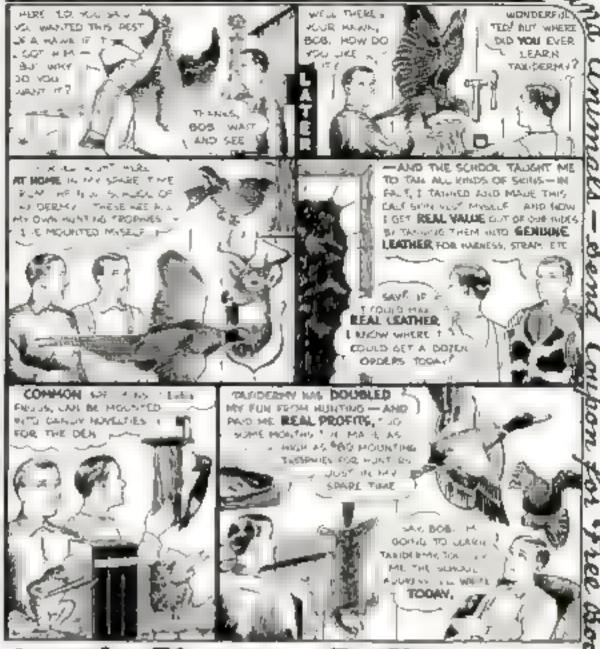
IF YOU own an old fashioned or unguarded wood shaper you should make a combination guard and hold-down to prevent the possibility of a serious act fent A survaille guard can be made by our ng a piece of an plywood to be shape shown A smal beveled piece of hardwood is guard on the undersade at the round end. In use, the guard is fustened to the shaper table with a same Column so that the hole is convered over the shaper blade. J P K



Using a wood shaper of old-lashioned type with a bomemeds guard encircing the cutture

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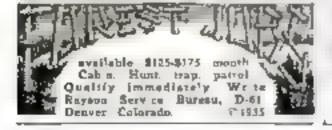
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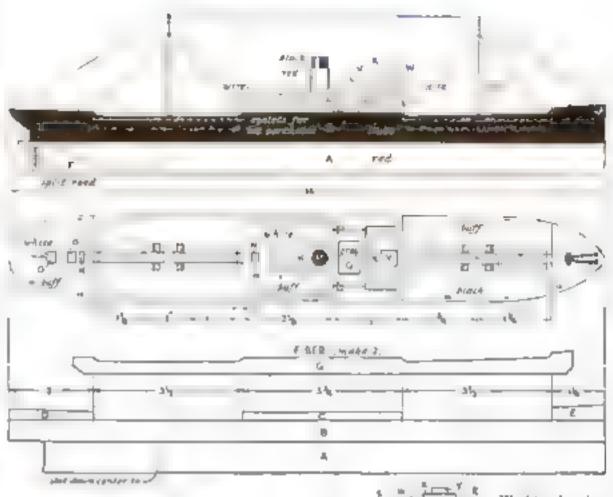


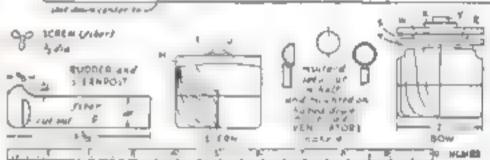




PICTURESQUE FREIGHTER MODEL

(Continued from page 57)





Working drawings of the freighter model with a scale in inches. The dimensions for most of the parts may be taken direct y from the last of macestals on the opposite page

and, using wood filler or a plastic wood composition, shape the hall where F joins 6 and B. Make the propeller shaft by attaching two short pieces of split doved or split need to F and attach the screw to the hub. Remove A and F from B and point them red

Proceed with the upper portion of the hull by gluing the fiber gunwales or bulwarks to the sides of B When thoroughly dired, madpaper the edges so that the fiber and wood join smoothly Now point the sides black the decks bull, and the edges of C, D, and E facing the decks, white

Out the remaining pieces to shape and assemble and point the various units separately before attaching them to one another and the hull. Most pieces are already shaped when cut to the dimensions specified in the fist of materials. Wherever possible, paint each piece before attaching it to another of a different color for instance, do not attach the lifeboats to the deck of M until each has been painted its own tolor.

The winches are made by gluing an eyelet and a short piece of wire to a cardboard base about 1/16 in. square, and then punting the unit black. The window is of umuar construction except that two eyelets are slipped over a piece of wire to form the drum, whereas one eyelet suffices for each winch. The

howse-pipe lifts, too, are evelets, as are all the portholes. The anchors can be cut from tard or fiber, pointed black, and glued in place. Short lengths of fine chain, such as used a theap sewelry, add a realistic touch when stretched from windlass to hawse-pipe lips.

The musts are round wood, tapered slightly with annipaper These must be inserted absolutely vertical. The derrick booms are long pins with heads removed, inserted into the wood to get their support, though seemingly suspended and attached to the masts. The gravity tanks a support rail V around the bridge house.

Ventilators are usually difficult to reproduce reaustitally (Continued on page 203)



A close-up of the midship section showing the superstructure. Note the ventilators, made from the shells of musterd steds

FREIGHTER MODEL

(Continued from page 102)

However, by having well-formed mustard seeds of suitable size, removing the tenters, and mounting the resulting balf shells on shaped dowels, excellent ventilators can be prepared. The bottards are made simply by gluing small pieces of black paper to the deck. and driving two short pieces of wire through the paper and into the hull. The protruding wire is then touched lightly with black point

The rigging follows the usual lines as shown in the drawing. The ends are held down by small pine driven into the bull and pointed

over to match the deck

If you intend mountage the model on a base, it is well to sail the underwater purtion first, driving the nails through piece A into the base. The upper portion of the model can then be set and glued on A, and short dowels may be used for additional security, if desired

List of Materials

WHITE PINE, BASSWOOD, OR BALSA

No. of species	T	W.	1,	For
1		_	. 1 3	4.
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1	14	40	4	X.*
i i	10	46	3-a	Y *
2	4		3 14	A 7 4
7			h.	Lifeboots
. 7				t mender

Note Rome marked with an aster sk(*) require no further equing or carring.

MISCELLANEOUS

- , pc. 14-in, round dowel wood I in, long ine 31
- I pc | 15-in mund towel wood 7 to long or mages, west access, propeller shall,
- I pe fiber about J by 12 in, for F and G, anchom, propeller etc.

t po card 6 by 155 in, for U

12 jans, 134 In. long for derrick broms, derrick posts, ric

About 5 ft. of thin, at if wire for davits, steam and whistle pipes, boilards, windinso and winches ev-

30 eyelets for portboles winches, etc. (very actiful state)

Some small mustard seeds for ventilator

Alous I in how chain for anchor chains.

Spoul or No. 400 stack thread

Black white red and buff paint or black, who e and red plune can be made to serve as they may be mixed together white predominating, to give a tint resembling buff) For gray, min white and black. Groe or cement.

PENNANTS FOR SHIP MODELS

Arren building the POPULAR SCHENCE MONTHLY privateer model Swaling, I was at a less for some time as to how to make her red and white pennant, which is about 4 in. long and tapers from 14 in, wide to a point. I finally obtained a manature silk American flag a little longer than the pennant, stretched it reasonably taut in such manner that only the long edges touched the supports, and applied a coat of clear varnish to cover an adjacent red and white stripe. After the varnish was dry, I cut the pennant from these two stripes. The variush prevents fraying.-Hatter J WALSEL



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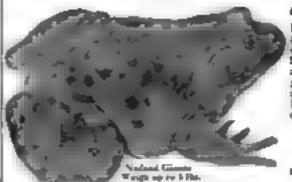






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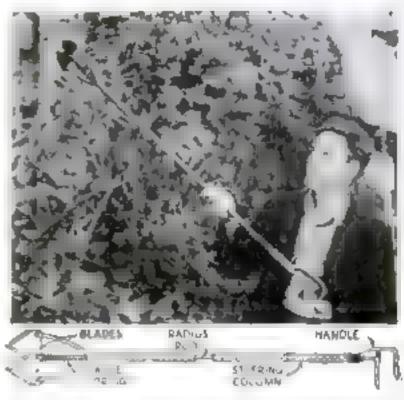
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BUY DIRECT AND SAVE

LONG-RANGE PRUNER MADE FROM JUNK

MADE mainly from spare automobile parts, this pruner has sufficient leverage to cut enally, yet it does not harm the burk as many other types of pruners are likely to do. The main bousing as a hollow tube from a strenng colump, split and bent like a fork at one end. Two blades (in this case mowing-machine blades) are pivoted at their outside corners to the ends of the fork. A rudius rod passes through the tube and is pivoted to the inner corners of the blades in such a way that when the rod is drawn through the tube by squeezing the handles together, the blades operate like shears. A valve spring is slipped over the rod between the end of the tubing and the blades to keep the blades open, except when the handles are pressed together, as shown in the accompanying diagram. Keep the blades well sharpened.—Pareis Emery



A powerful preser for reaching inaccessible branches. The an are operated I he abears when the hand on are squeezed

INEXPENSIVE DISAPPEARING STAIRS

AN UNFINISHED attic, with no place to put a permisent stairway, brought the solution shown in the accompanying photographs at a cost much less than the price of

ready built deappearing stairs

The space available determined the dimensions. A trapdoor, shown closed in one picture, was made and hinced at one end so that it would swing down with the stars. At the free end a widing spring catch with a ring or loop was placed to lock the door in position, although because of the counterweights the door automatically stays in the closed poution unless pulled down. A small stock with a hook in the end is used to pull the trapdoor down. The stick is preferred to a drop cord, since it can be hung belund the hall door when the stairs are up and is out of sight

The stairs consist of two sidepieces and steps, the length being determined by the amount of pitch desired, the beight of the ceiling, and the space in the attic. The sidepieces slide over a piece of pape fastened at the head of the stairs, although flat casters mounted with the rollers up would be better. Flat metal

strips, which are bent into the form of books and set into the underside of the two sidepieces, catch the pipe when the Bairs are pulled down and prevent their coming too far-

trusde pieces at the top keep the stairs in line, being assisted in this by metal guides on the lower end of the trapdoor. These metapieces, is addition to keeping the stairs from swinging out of line from side to side are also bent over the adepieces of the starts to keep the trapdoor from dropping away from the state.

Heavy such cords, fastened at the foot of the stairs, extend through pulleys near the lower end of the trapdoor into the attic and over im less at ached to rafters. At their ends are counterweights, which drop into wells of the partition walls when the stars are pinhed up. The puners on the trapelour are placed far. enough from the end so that when the stars are pushed up, they will swing up into the athe on top of the door wranout striking the end of the door casing

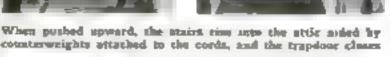
The ropes pulling through the pulleys on the trapdoor hold the door close against the

> stairs so that the metal guides do not wear the sides of he stairs. The stair steps do not extend beyond the back edges of the indepieces, to do not strike the eage of the trapdoor. as the stairs are shoved up from the floor

> The counterweights, if heat y coough, make the lifting of the staus very may, and these weights, logether with the overbalancing of the upper end of the stairs when pushed up, swing the sture and trapdoor into posit on without further effort after the stars are flurted up, and the trapdoor thereupon closes automatically, -EUGENE A. HANCOCK

> When tapping bakelite or other soft materials, first tap a steel plate and damp it in onstron, then drill through the hole in the plate and use the threads as a guide for the tap itself --- H. C





Open parties

Full Address

Nanur

IS JUDITER JANITOR OF THE SOLAR SYSTEM?

(Continued from page 30)

level with the top of the mercury column after the bulb has been inserted into the ball.

The result is convincing evidence, I believe, of the truth of Godfrey's theory that Jupiter maintains and periodically raises the sun's heat. When I performed the experiment, there was little change registered in the temperature of the ball's interior for the first two or three manutes of rolling. After this, however, the mercury mounted rapidly and soon showed the bull's center to be ten degrees botter than at the start of the kneeding motion.

WHEN the mercury rises in this simple demonstration of heat production through internal friction, it illustrates what must take place constantly in the sun's interior because of the moving distortion caused by the attraction of Jupiter In fact, Godfrey tells us that if it were not for this distortion and internal friction, the solar system's apartment in space would be too cold to sustain human life -or any other kind. In other words, the sun, unless constantly "stoked" by Jupiter, would go on forever with "banked fires," leaving its planet family to freeze

But how does Jupiter, the solar-furnace man, get up a few pounds more of steam which Dr. Abbott's pycheliumeter exceeds at the times of greatest sun-spot activity?

To answer this we must remind ourselves that the gravitational forces between two heavenly bodies vary as they approach or re-cede from each other. We must also remember that Jupiter, like all the other planets, moves round the sun in an elapse instead of a circle. with the sun at one of the ellipse's two fort Jupiter is accordingly about 46,000,000 miles nearer the sun at one part of its orbit, called perihelion. When at its nearest point, the planet brings considerably stronger distorting force to bear on the solar globe, causing great Increase in the internal friction and the best il creates.

To convey some idea of the terrific force which binds Jupiter and the sun together, Godfrey tells us that it would require a solid steel cable averaging 40,000 miles in diameter to sustain the pull! No wonder that even a small increme in this attraction, an Jupiter approaches its perihelion, can account for such extra activity-greater friction and heat generation within the sun, and more sun-spot outbreaks.

As a matter of fact, the greater theoretical heating action of Jupiter on the sun at its nearest approach is remarkably well supported by the facts. Since the number of sunspots appearing at any one time is a rough measure of the sun's heat output, we can construct a diagram to show Jupiter's effect. This is shown graphically in the record of the maxmum and minimum numbers of sun soots counted for filty years, with a record of Jupiter's perihelions and aphelions running apprusimately parallel with the respective high and low points of sun-spot activity

*OMPLETE conformity could not be exs pected, because of a great many other factors, such as the variable "stoking" effect. of the cight smaller planets. Their influence is far from negligible. In fact, Godfrey considers the extent to which they reenforce or oppose the pull of Jupiter as responsible for part of the variation in warmth of our summers and winters. The diagrams illustrate this important. point.

Further research on the sun's heat, and its variation, is being carried on in various parts of the world and may result in a new explanation--but meanwhile the theory that the planets themselves enforce their demands for more heat upon a reluctant and unwilling sun seems to have much scientific evidence to support it.

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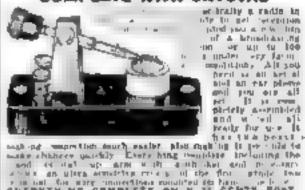
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Mountain Scenery

FOR MODEL RAILWAYS

WNNELS, mountains, and fullsides for a model railway that have all the beauty and charm of a natural background can be made of coteent and sand

Two ends for the tunnel are cut out of 1/2un pine with a slope or roll at the top odge to give a natural contour. These are joined with strips of thin wood, after which the entire top and odes are covered with fine wire screening. In place of wire, state-surfaced roofing maternal may be used, the chief advantage of which is that it gives a better finuh on the inside of the tunnel, if the layout is such that any part of the interior can be seen. A miniature socket is inserted at about the top center, projecting through. It is used lo give a camp fire effect

A stiff mixture of one part cement and two parts screened sand is applied to cover the wire acreening. When this mixture has set up, but before it is dry, more of the one-totwo mixture is prepared of such a density that it will remain in any shape. The first coat is covered with this, and the roads. brooks, rocks, and other features of the mountain scenery are formed. Even the little cabins along the roadside may be made of it unsem houses are available such as those used in Japanese dish gardens,

Trees and bushes are pieces of a sponger toaked in water and embedded in wet cement. For larger models, pine cones, painted greets and tipped off with red, yellow, or white, may be used. They make more realistic bushes than sponges do. A road winding up the mountain can be made to stand out by imbedding white pebbles in the wet cement.

After this mixture has set, so there is no danger of its sliding, certain parts are given

a cement stucco finish by mixing clear cement with water to the density of thick cream. and spattering on with a whisk broom where necessary to resemble dry leaves and twigs. Small forked twigs are laid flat on the top or overhanging the sides, and are beld in place. with a lump of cement, which, when pointed, represents a stone that has rolled down the mountain and stopped at the base of a tree

it has felled.

After the cement has been allowed to dry unduturbed for a few days in a cool place, a cost of varnish size is appured. While this is still tacky, daub on spots at various points with green, rod, black, blue, orange, white, and as many colors as may be available. Then blend them together. Here and there up off a high spot with pure white, and other spots with throme yellow, to give the effect of wild flowers. The trees and bushes are painted various shades of brown and green and then upped off with white, yellow, red, or a lighter shade of green.

A red or orange lamp is placed in the socket. and covered with small twigs. When the room is darkened, this gives the effect of a fire burning on the mountain top. Lights may be placed truste the tunnel, if desired, and for signal lamps, crystal-cut red and green glass markers may be inserted in the end walk so that the light shines through

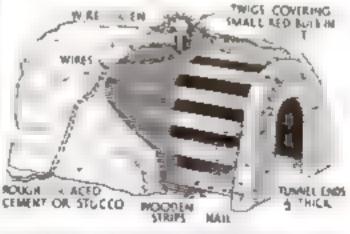
them

The ends are painted either brown or light gray, and while the paint is still wet, they are sanded with dry white beach sand. Lines may be scored with a pencil around the openings to give the effect of stone arches.

A few pretautions taight be esentioned. Do not attempt to hurry the drying of the cement with heat, and do not jur or even move the

model while drying. Before starting the painting, let the tunnel dry until the cement has regained its original light color If slate or stone-surfaced cooling material is used instead of wire screening, keep the rough side Sppermest.

Mountain peaks with trains passing behind them may be made in the same way. An irregularly shaped back and baseboard are sawed out and united together at right angles, and wire screening is tacked from the bottom edge of the baseboard to the top edge and sides of the backboard. This is finished in the same manner as the tunnel, except that the ministure houses and individual trees may be umitted HAROLD W LONG.



General method of building a durable tunnel for a model railway. It can be madefied to said only access layout

BUILD THIS RECEIVER WITH METAL TUBES

(Continued from page 53)



Covers for stage shields can be formed as follows. For the radio-frequency stage, an 8 by 9-inch aluminum sheet should be bent down at right angles one half inch to give a cover 1/5 by 7 by 8 inches. For the audio stage cover, a 7 by 9-inch sheet bent to give a cover measuring 1/2 by 6 by 5 inches will serve. The audio shield cover should be supplied with ventilation boles.

In selecting the parts listed chewbers, pay particular attention to the transformers. The power transformer should be capable of delivering 400 volts, center-tapped at 200, and have a current rating of approximately eighty miliamperes. For sudio amplification, the input push pull transformer between the plate of the bCs to the two golds of the 6134 should be of the conventional input pushpull type. For the output power transfer of energy the output transformer should be of the type normally used in connection with panh-pull type '45 tubes and a 1, 2, or 3-ohm dynamic speaker voice cod

The paris required for the construction of

this set are as follows

C. and C.—Variable condensers, 140 mm! Ca, Ca, and Ca-Fixed condensers, O1 mid. Cound Cu-Fixed condensers, I mid

Cw and Co.-Fixed condensers, 0001 mid Co. E egirolytic condenser, 25 mfd 25 v Co and Co-Fixed condensers, 5 mid. Ca and Ca-b ard condensers, 1 mld

Cn.-Electrolytic condenser, 5 mld., 400 v Ca-Dual electrosytic condenser, 8 mfd.

C₁₀—Fixed condenser, 000) mld R₁—Yolume control, 0.000 ohm.

R. Fixed resistor, 100,000 ohm, 1 watt R.-Fixed resistor, 400 ohm, 2 wall

R.-Fixed reastor, 150,000 ohm, I wait

Ra.-Fixed resistor, 25,000 ohm. 2 watt Ra.-Fixed resistor, 10,000 ohm. 3 watt.

Volume control 50,000 ahm. R. I sed resistor 60,000 ohm, 1 watt.

R.-Volume control, I meg Ro.-F sed rese or 2 50 ohm, 2 wait

R -Fred reastor, 60,000 ohm, 1 watt

Rat. - Fixed resistor 100,000 ohm, 1 watt Ris. Fixed resistor 900 ohm 1 watt

R i. I-xed resistor, 25,000 ohm, 25 watt

Rise Grid leak resistor 5 meg. To-Power transformer, 400 v., center

tapped. Push Pull input ransformer

T, Push Pull output transformer R F C .- Radio frequency choke, 2.5 mh.

Chi.-Choke, 300 h Chq.-Choke, filter, 10 h

Li.—Four-prong plag-in cods. L. Six-prone plug-in coils.

Miscellaneous.- Five-inch dynamic speaker (2,500-ohm field), dial, aluminum, all metal lubes, wire, solder, etc.

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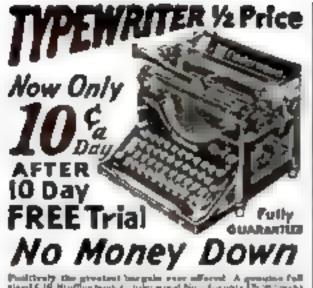
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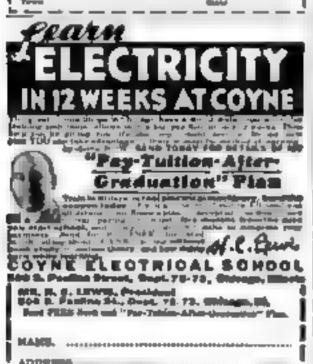
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CRAFT SERVICE

DIESELS USHER IN NEW AGE OF POWER

(Continued from page 13)

Early this spring, a series of spectacular runs at Daystona Beach, Fla., focused attention on the spred possibilities of the modern Diesel. Dave Evans and "Wild Bill" Cummuns streaked along this strip of silver sand at speeds that added miles to the world's record for such machines. Powered with stock model, truck-type Diesels, Evans's machine reached 125 miles as hour and Cummuns's 137 miles as hour in officially timed runs, Both rates rode to Florida from the North on Diesel-powered trucks.

A TRUCK with a Cummins engage, in midwinter, 1933, gave one of the most remarkable demonstrations of stamina on record Day after day, for 14,000 miles, it riccled the track at Indianapolis, averaging forty-three miles an hour and traveling 19,000 miles without refueling, 13,585 without stopping the truck, and all of the way without shutting off the cogine?

The same enone carried a 17,000-pound track 3.111 miles from coast to coast in ninety seven and a haif hours at a total fuel out of 5.111 This averages a ten h of a cent a ton mile in addition the Cammins engine boards the official transcontinents, record for himses in 19.11 of carried a lo., Los but transvew 3 sek to Los Angeles in accenty-eight bours and ten minutes running time. The average speed was more than forty miles an hour and the fuel bill was only \$21.90.

On rails as well as on roads, Diesels are making history. The Burlington Zephyr and other streamline trains depend upon oil-burners for their power. With its ool-horsepower Winton Diesel, the Zephyr covered the 1,015 miles between Denver, Colo., and Chicago, Ill., in thereen hours, reaching a peak speed of 112 miles an hour and clipping the normal running time in half

While such streamline trains are a recent innovation, Diesel-run locomotives have been known since 1911. In that year, a pioneer was put in service on a railroad in Switzerland.

The spectacular advance in bullet trains has turned public attention to the accomplishments of the Dienel in other fields. At sweets, all but the smallest farm tractors are od-burners, In a number of instances, the cost of fuel to run a big Diesel tractor was seas than the cost of the driver's meals?

IN THE construction field, the record is just at striking. Cranes, shower, crishers, boists, compressors—more than thirty manufacturers are producing such equipment run by these encines. On the water, fermes, towhousts, yachta, and fishing graft likewise are powered by these motors. The hileboats of the new British liner, the Queen Mary, will carry encines of this type

The largest all Diesel ship affort is the Itahan liner dagn to which pites between Europe and South America. Seven hundred and ten feet long, it is registered at 30.415 tons. Close behind it are the Canard-White Star vessels, the Georgic and the Heitennic The former is a 2 - 59 ron ship, the latter a 26.944 ton one. According to the latest matistics, approximately ninety percent of all tankers under construction are being fitted with Diesels.

In a host of cities, Diesels are carrying the burden at power houses, pumping stations, and seware-disposal plants. Locks at the Panaria Canal have Diesels to aid in moving the massive gates. Even on the pipe lines that carry crude oil to the refineries, Diesels force the black petroleum down the miles of steel tubes.

During the manufacture of the latest engines, the grinding of the parts is so exact that, in some cases, the workmanship can be checked only by projecting the shadow of the part on a greatly enlarged drawing.

On the skyways, the advantages of these eactors is obvious. They would reduce the fuel load, remove the fire basard, and eliminate the dangers of carburctor or ignition breakdown. The late Capt. L. M. Wooken, with his Packard Diesel—a 125-horsepower motor weighing only 310 pounds—led the way in America. Now, practically every major country in the world is seeking a perfected high-speed Diesel of the sir,

Added impetus has been given to the development of Diesel-powered struraft by rumors of the invention of a mystery-ray apparatus that would bring down planes by interfering with their lightion systems

In line with this quait, France has just offered a prize of a million france to the citaten who can develop a Direct expands of meeting the requirements of a pursuit plane.

ACROSS the border, Germany is installing Diesels in the transport ships of the Lufthansa, giving them millions of miles of testing in the sky, grooming them for use to huge bombing planes which are expected to be a deadly feature of the next war. At the same time, England and America are active in the study of ignitioniese engines.

In recent tests, the Junkers "Jumo," the type of Diesel installed in the multimotored Lufthansa planes, showed it could maintain 650 horsepower up to 11,400 feet. It weighs only 2.6 pounds per horsepower. In other rountries, famous motor builders are producing experimental Dissels—the Suphsam concern in England, the Flat factory in Italy, the Clerget plant in France.

Biggest of all sizeraft Diesels under construction is one reported from a midwestern factory. It is an inverted V-type engine with twelve water-cooled cylinders, Built according to the design of a Beignan inventor, it is expected to develop 1,200 horsepower

In various parts of the United States, Diesels are taking their places beside steam turbines in producing electricity. At Turson, Aria, for example, coal costs approximately right dollars a ton white fuel oil costs in tank cars at less than five cents a gallon, Here, the power plant which produces current for the city is run entirely by oil-burning Diesels.

Similarly, at Menasta, Win., the townowned power plant has used Diesels for twenty-five years. And it has been turning out electricity for less than two cents a kilowatt bour. In other places, utility concerns are installing the engines to carry peak loads at moderate-sized stations.

Slowly but surely, these economical, dependable power plants have been finding new uses. Now, through a spectacular advance, they are bringing nearer the long-predicted Denel age in the world of power

COLORS HELP PIGEONS LOCATE THEIR LOFTS

Honormo pigeous can find their lofts, particularly if they are mobile, more readily if the lofts are painted distinctive colors. This discovery, it is reported, was made at the Schofield Barracks of the U.S. Army in Hawaii. The use of distinctive colors, the Army men found, was as effective at night as during the day. Colored lights were used at night Each loft in addition to its distinctive coat of paint, has its own individual number and formation of colored signal lights. This color-andlight system enabled Army birds to set a workin record for night flying. Their time averaged only sixteen yards per minute slower than the day record.



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POPULAR SCIENCE MONTHLY 253 Fourth Ave., How York, N. Y.

FROM COAST TO COAST IN A MODERN AIRLINER

(Con much from Juge ab.

off-with an ear to the phones. At any secood, the pilot may pick up his transmitter and instantly raise the ground operator. At no time is vigilance related, even for a momeni

Here we come in contact with another of the marvels—the third pilot. You've guessed it. The third pilot is a robot a hirle metal box weighing perhaps that's the pounds out it is the most An ful prior imaginable. Operaring on the evrose sie principle, it guides the plane unerringly on its way, instantly correctme any deviation from its course. It is especially valuable in thick weather, leaving the priots free to study their instruzoents and traps and attend to their radio

NOW comes the most beautiful fix ne of the ground glow, so that we appear to be its ing under a great canopy. The air is still and calm. We appear to be hanging in space as I suspended on some great my water thread. There is no motion, and little sound except a high-pitched whatling like that of a peanut vendor's wagon. The whistling is caused by a 155 mile an our pair nutside the car to for we are hurtlin, through the air at more than three miles a minute

Soon darkness falls, and tiny pin points of light flicker on the ground. Our nay gation lights- a green light on one wring tip a red on the other and a whote heat on the cast snap on These are to warn other planes flying on the same sarwa)

Vight-black, inky night-folds around us The lights of little towns sparkle below us like tousters of diamonds.

To our left, we see a brilliant flash, it is retwated every ten seconds. It is one of the 2 000,000-candle-power beacons strung along the nirway, five to ten miles apart. Far beyond, we can see another and another, sometimes as many as five or six are its sight at once on a clear might. They are part of the unbroken chann stretching from ocean to ocean, act no the New Jerses marshes, the Atlepheny month, the practic states, the towering Rockies

I show up each flash, there is a tapid dotdash when he has so that in both bisery thank macon has a green light, indicating it is an emergency field, and, as we near it, we see the rectangle of boundary lights, marking the field's emits. If need be, we might land here. By switching on the two 500,000-randle-power headlights sunk into the nose of the place, the priot can illuminate the field and land. At any field, we would find a caretaker, a telephone, gasoline, and food

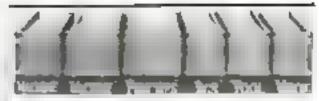
These fields average between twenty and thirty miles apart, representing a continuous landing field from coast to coast, thus a ship flying 185 miles an hour in always within three to five minutes of a regular landing

AS A further safety precaution, the plane is required by law to carry parachute flares, great magnessum lights which can illuminate as much as a square mile of the earth below them as they descend

We reel off mile after mile of inky darkness, jeweled patterns of towns, and fla hog beacons. Then the flare of Gary and East Unicago mills. The dispatcher in the lower at the Chicago airport hears our motors and switches on the great floodlights. We slide to a landing " " miles and an even four hours and furty-five minutes from New York. It takes about eighteen bours on the fastest limited trains

Forty minutes fater, after an inspectson and a 385-gallon drank for the gasoline tanks, the plane is ready for the pext hop. The lights of Chargo fall astern rapidly

Lp in the dark- (Continued on page 110)



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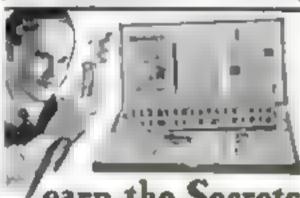
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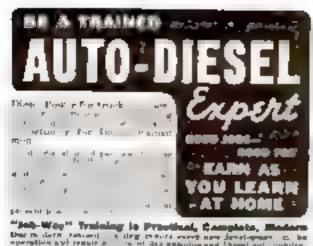
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FROM COAST TO COAST IN A MODERN AIRLINER

(Continued from Juge 209)

ened cubin, the pilots are using still another part of the ground organization, the part that has made bud-weather flying not only possible, but practical-the radio range. Every foot of this airway is covered by a rutho range beacon, which guides our ship on its path as onerringly at the two steel rails guide the railroad train.

The tunge stations are 200 or 250 miles apart. Each sends out a radio beam, a narrow band composed of two interlocking radio ugnals, like the beam of a lantern, which broadens the further it gets from the station On either side of the range are broadcast constant streams of dots. At the far end of the beam, it may be several miles under near the station, it may be a few bundred yards wide

O LONG as our pilot keeps on his course, be So Luxur as our pure expensioner but the steady stream of long dashes, guiding him on. But suppose that he edges off to the north. As soon as he drifts over too far to the right, he hears the dots breaking into his dashes, form-ing the code letter "N", All he must do is turn to his left ustill the dots lade out, and he gets the uninterrupted long dashes again.

Radio is being put to still another ine-for blind landings. By use of the new equipment, the prior is guided into position over his defination sirport, when he is unable to see the ground and then is guided onto the field unerringly and as accurately as if in bright sunlight.

But already it is 11 P.M., and we are circling to the left over Kanses City's surport down in the Missouri River both m 1935 miles from New York, Kansas City is the nerve center and the aircraft repair base. Big maintenance shops here at regular intervals work on every plane on the line

Only mechanics licemed by the Department of Commerce are permutted to work on these ships. When a plane comes in for its periodic check up, a proved schedule is build over one propeties and the workmen go over it point by point, checking off each item as it is completed

After twenty-five hours in the air, the motie covers are taken off and the engines are given a top overhaul. After 300 hours, the motors are pulled out altogether and taken spart, piece by piece. If any part shows wear, it is replaced immediately

At the same time, the three-bladed propellers are etched with acid which will show up any flaws or traces of metal fatigue.

Soon it is time to leave. The maps show fair weather, broken only by a few small storms, all the way to Albuquerque, 702 miles away, the loopest jump of the trip. Albuquerque is awake and waiting for us. We sink through the light in what the pilots call a "hot" landing, for we are in high country now and the ate is thin,

N THIS western wilderness are scattered I air beacons, and emergency fields, just as thickly-possibly even more so-as in the inhabited east and the Prairie States. Some of the beacons are in such remote sections that it is not even practical to have carelakers. Astronomical clocks, regulated to active for the seawho turn on and off the general hig engines at mghtfail and daybreak. At the emergency fields, the caretakers are isolated, cut off from cay stative, sometaines for weeks or months

It is the wit now. A gigantic ball of burnished copper rises in the East, playing kalesdoscopic traks with the great white cloud formation and ravelur wreaths of morning (og

We are suppose lower Houses take shape and rotor As our wheels touch the Los Angeles aurport, the teletypes flash the signal

"The Sky Charf landing on time."

HOME TESTS EXPLAIN HOUSEHOLD PRODUCTS

(Continued from page 31)

also be applied as a solution, which is made by dissolving a rounded tablespoon of the mard powder in a gallon of water A potted plant of about six-inch are should receive one gill of this solution at two-week intervals. Plants in your garden also will benefit from doses of the solution.

From mick, modern usdustry produces such varied products as billiard balls, medicines, jewelry, and adhesives. On a small scale, you can duplicate some of these feats of themical magic. Slummed milk, or milk from which the top cream has been removed, will serve as your raw material.

Dilute the milk, with water, to twice its original volume. Then add dhate hydrochloric and—about one surt of and to four parts of water-while starting. A precipitate will form. Let it settle, and then add more acid. If a precipatate appears again in the upper or clearer part of the figuid, still more acid will be required. Continue saiding the acid until no more precipitate forms.

THE precipitate, a complex substance known as casein, must now be recovered by filtering the liquid Filter paper will not do, because of the colloidal nature of the whole mixture, but a single layer of chresecloth placed in a funnel works nucely. After the liquid has run off through the firer, pour copious quantities of water after it to wash impurities from the case's remaining on the cloth. Finally, rime the precipitate with alcohol and then with ether

The rimes with alcohol and ether, while not absolutely necessary, yield a purer and flattler product. If they are omitted, the casein, scraped from the cloth and dried, will be hornlike because of the water and butter fat it retains. The alcuhol removes the water, and the ether takes out the butter fat.

You can make a purcolainlike cement, very useful around the home and aboratory, from 100 parts of rasem, five parts of water glass, and five parts of dry lime (calcium hydroxide), mixed intimately and brought to the deured consistency with water

A quick-hardening general may be made from 100 parts of the dry casein, twelve parts of tye (sodium hydroxide), and fourteen parts of magnesia (magnesium oside), mixed into a paste with water. For a wood putty, rub with water 100 parts of casein, twelve parts of borus, and about twelve parts of dry lime, Anadhesive preparation may be made from 100 parts of caselo and about fourteen parts of burns or dry lime, rubbed to a dough with water, more water should then be added to form a workable paste. Dry mixes containing casem which are to be mixed with water and used as achesives at some later date, usually contain a most preventing substance such as sodium saliculate to act as a preservative.

FLIES BECOME ASSETS TO MUSHROOM GROWER

An unjusual method of disposing of swarms of fires was recently adopted by a mushroom grower who was confronted with a plague of flim which hatched in the manure he used as fertilizer. An engineer friend arranged the installation of a suction fan which removed the flies from the mushroom beds and passed them over refrigerating coils. The chilled and dormant flies were then allowed to drouinto large milk came. In these containers, they were shipped to commercial Irog raisers. When the latter received the cam, they immersed them in a brane solution in order to chill the flies and render them dormant again. In this condition, they are fed to the frogs. Now the mushroom grower realizes nearly as much from the sale of thes as from mushrooms.



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NEW SUBSTANCES FOR ART AND INDUSTRY

(Continued from page 21)

forms in every city and town. Teasters, camerus, telephones, radius, granding wheels, butthe caps, ignition parts, door knobs, roller skates, all are made of these molded plastics.

By laminating plasters with fabric, paper, and other materials, a linst of new products has been made possible. The paper-lamanated stock is used for table tops, tadio panels and similar articles. The linen-or canvas-laminated material is made into timing grass for automobiles and motor pinions on factory lethes Such products are as strong as cast iron and possess the added advantages of silent operahup and resistance to corrosion.

RAPHITE is embedded in other types of laminated phatics to provide automatic lubrication when the material is employed in bearings. Utaphate impregnated cloth usualy gives the lubracating character to such bear-

In solid sheets, laminated plastics form the walls of booths and the doors in many public bundings. Recent v. an eastern califord termany installed synthetic resit doors havethout. Not only are they easy to keep clean and hard to scratch or mar, but they are eatirely fireproof. Tests with a blowtorch showed that this material could withstand a temperature of 1,800 degrees P

To provide special, high-speed artinding wheels for a wide variety of purposes, abrauve particles are now being bonded with Bakelite, As many as 40,000 cutting chips, tests showed, lie on the surface of an average twenty-four-lach wheel, four inches wide made by this process. Spinning at a speed of 9,500 surface feet a minute, such a wheel would carry 75,000,000 cutting points across a given spot, in the space of a single minute And, some wheels of this sort now operate at speeds so high no 10,000 surface feet, or three miles a minute!

Another field in which synthetic resins are forging ahead in that of punts, enamels, and varnishes

A year ago, when the America's Cup defender Rainbow swept over the final line ahead of its British rival, it was protected from the saft water and spray by several kinds of synthetic-resin paint and variash

Ten thomand miles away, in Australia, another boat—a tiny forty-pounder designed to ride in Sir Charles Kingsford Smith's air plane-gave an even more dramatic exhibitson of the powers of this new-type varnish. For three days, the boat was submerged in sea. water. When it was brought to the surface and dried out, it had not gained a single ounce of weight. The varnish had formed an impervious costing which the galt water could not affect

A THIRD striking demonstration occurred at Ambeidge, Pa., a lown not far from Putsburgh. Here, a milion-gallon water tank provided the unique testing ground for 190 kinds of coating material. The inside of the great tank was laid off into 196 vertical strusrunning from top to bottom. To determine the relative durability of various paints, the experts coated each strip with a different kind At the end of a month, they examined all the panels, at the end of six months, nine months, a year, eighteen months, they examined them again. Their report, at the end of nearly two vears, showed that the only paint that persed the test with a perfect acore was one made with a synthetic-resia base

least before such plastic-base points anpeared on the market, they had survived one of the most grueling examinations ever given a new product.

Research tren weathered them in sun, wind and rain, they soaked (Continued on page 212)



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NEW SUBSTANCES FOR ART AND INDUSTRY

(Continued from page 211)

them in caustic solutions for twenty-three hours; they boiled them in water for seven hours, they sprayed them with gasoline, nounded them with hummers, exposed them to tage and sait spray, scrubbed them with strong alkali cleansers, and, finally, spun them 20,000 times in a machine filled with flying sand grains. In every test, their reports showed, the synthetic-resin paints and varnishes stood up better than similar contings without the plas-

Special types of plastic paints are manufactured for hooses, boats, and bradges. One quick-drying varues is made with an oilsoluble synthetic-resin base. It is rubbed on furniture like lemon of and permitted to

Another kind of synthetic-resin varnish protects armatures on electric generators from injury by oil, gusoline, or inbricating groue. Installations so protected range from grant armatures, twice as high as a man, to midget ones designed for small granders.

Strangest of all applications of these varhishes is one reported from an eastern museum. The skeletom of dinosaurs and other prehistoric monsters are being coated with the liquids. They have proved themselves best for protecting the remains of creatures representing life on earth bundreds of thousands of years ago,

Another new use for synthesic reum in the held of science is in holding metals for microanalysis. The bits of material to be examined are fixed in a block of hardened Bakelite This gives them a solid support during the work of examination.

MEDICINE, as well as metallurgy, is benefitting from applications of the new plastics. A device made of a thermoplastic substance is replacing the familiar gause masks worn by nurses and surgeons in the operating room. Oxygen tents for hospital patients now have transparent plastic windows. X-ray operators are protected by lead-falled Bakelite Shields to protect vactinations, and an adhesive tape which has a plastic has that makes it unaffected by water, are other aptective he met for miners, made possible by the use of light weight plastics.

How much punishment the latest plastic substance will stand in illustrated by breakdown tests made on a mechanical counter designed for the on high-speed factory machines. At each revolution, a brouse pawl connected with a laminated-plastic ratchet wheel. For seventy days and seventy mights, the apparatus run at the rate of \$16 impubes a minute, a total of 49,000,000 impacts on the wheel. At the end of that time, it was the broase pawl, and not the wheel, that gave out. Engineers who grammed the wheel reported it was good for another 50,000,000 ampacts [

Not infrequently, the manufacturers of plastic substances have to develop special formulas to meet the needs of a particular product. For example, when broadcasts from electrical recordings came into unde-spread use, one of the largest producers of the records appealed for a new material that would connecte squeaks. The engineers and chemists of a plastics laboratory immediately set to work. They solved the problem, developing an entirely new material.

Most of the thousands of new uses for plantics have been found in the last decade. The greater number of synthetic substances now making industrial history have been born since the World War. The field in new. But it is a field of spectacular accomplishments, of amazing possibilities. It represents a crowning achievement of the industrial chemist.

GUS GIVES A LESSON IN CAREFUL DRIVING

(Continued from page 56)

driving. You know the kind of a fellow I mean. The bird who barget across a blind crossing because he thinks there's not much chance that a car will be toming the other way, the dumb-bell who starts on a long drive with poor brakes because he's willing to take a chance that he won't have to stop quick, the fellow who cuts around a curve on the wrong sade of the road, or passes another carwhen he can't see what's coming, because he thinks there iso't much chance of a car coming the other way-and that his luck will save him if there is."

"I see the point there, all right," Montrose admitted. "It's the gambler's instruct you should leave at home when you go out in the

"That's it, exactly," said Gus. "If you never gamble on what the other fellow is going to do, you'll be ready for him no matter what fool stunt he pulls,

"Always seemed to me speeding cause a lot of accidents, too," Montrose ventured.

THAT all depends on what you can run a speeding," Gus replied. "You can run a "HAT all depends on what you mean by chance of hundres in (all on a homicide charge when you are driving only twenty miles an hour, and yet you may be as safe at twice that speed as you would be at home in hed. It all depends on the time and place."

"How do you figure that out?" Montrose

wanted to know

"Have you an hour to spare?" Gus asked. "If you have, drive over with me to Carville while I do an errand, and I'll show you what

Montrose readily agreed, and the two men

climited at a Class car

Now " and Gus, as they turned late a wide state road, "this stretch is over four miles long, with no sharp bends or conceated turns. There are only two entering roads, and you can see a car coming on either of them ocarly a quarter of a mule away. There's no doubt but what this road is safe for forty miles an hour. Of course, there's drivers would say it was tale for sixty, but there's no sat sfying that type. If you made the road really safe for sixty, they'd want to do a hundred.

"Of course," Gus went on as the speedometer needle crept up to forty, "this speed is really safe only if the tires on your car are good, the steering gear is tight and in perfect thaps, and the brakes are right. On the other hand, a fellow was nearly killed last year on thas road because he was going too fast. He was only doing forty miles an hour, and he had the road all to himself, too."

"What happened-a blow-out?" Mont-

rose inquired.

"Nothing gave way on the car," said Gus. "He was blown off the road! You see there were some icy spots on the concrete, not enough to cause any trouble, ordinarily, but there was a sixty-mile gale blowing, quartering across the road, and as he hit an icy spot an extra hard blast started the car into a skot that ended out there in the field with a busted. spring and a damaged mudguard. It sure was lucky for him it happened right there rather than farther along where there's a bank he'd bave gone over

"B LOWN off the road by the wind!" exlieved it possible that what pressure could do anything like that."

"It did, just the same," Gus maintained, "and if you don't believe that a 100-mile-anbour breeze packs a punch, just get caught in one of those Kansos "twisters" and see what happens to you.

"So the answer is to watch your step on a windy they if there's (Continued on page 113)

ADDRESS







Electrical Positions

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GUS GIVES A LESSON IN CAREFUL DRIVING

(Continued from page 112)

any chance of slippery spots on the road. I'll make a note of that one," said Montrose.

"Here, said Gus, "is where you see the other side of the speed story." They had turned into a narrow street through the densely populated outskirts of Carville School had just timed, and children of all ages were throughed the streets.

Twenty mues an hour would be too fast through here, tight now," said Gun as they crawled along at a bare twelve miles an hour "and you've got to keep your tyes peckel and your foot on the brake every second, in case some youngster daris across in front of you Yet, you could sail through here at thirty miles an hour in perfect safety at two o'clock in the morning. So you see you can't say off-hand that any particular speed it safe or not safe till you know all the circumstances."

"I hadn't thought of it before but the time of day would make a lot of difference," the

passenger agreed

"You bet it does," nocided Gus. "Figures show that the most accidents happen between five in the afternoon and eight in the evening. Twilight coming on, people hurrying home from work, kids out joy riding, everybody a little tired after the day's prind—everything seems to work together at that time of day."

GUS soon fireshed his business in Carville and headed for home

"I suppose shiptery touch and ramy weather cause a lot of accidents," Montrose volunteered, as the car picked up speed in the open country

"Well, that's a funny thing," replied Gui.
"Of course, slick asphalt or a bravy fog makes
driving a lot more dangerous, and does cause
accidents. Yet, I was reading, just last night
that four out of five fatal accidents happen on
dry reads and in clear weather."

"Well," said Montrose, as they pulled up at the block! Garage, "It looks to me as though the whole problem of sale driving can be tioiled down to a mighty simple rule and that is: Never take a chance on either your car or your driving; he sure, and you'll never be sorry—of worse!"

"That's the whole thing in a nurshell." Gus agreed, "and if the police departments can ever get every driver to paste that idea in his hat and stick to it there it be so few accepted that the cost of liability insurance will drop to the price of a new tire

"That won't mean a thing to Rummy Dunkins," laughed Joe, as Montrose drove off "He should worry! They say Providence always watches over fools and drunkards!"

"Not when the drank is behind the wheel of an automobile?" grunted Gus as he started work on the next job.

COMMON CHEMICAL KILLS ONION AND GARLIC ODOR

LATER Of cours and garlie may now indulte their taste and none will guess their secret, as a result of recent discoveries by hale haiversity physiologists. The persistence of these odors in the breath, which had hitherto invisited scientists, was found to be due in artimate substances known as essential out that cling to the surfaces of the mooth, tongue, and terth after gar no

An instant and effective remedy, the experimenters found, was to wash the teeth and tangue and riase the mouth with a solution of chloramane, a chemical available at drast stores. The chlorane liberated by the solution, made by dissolving one 4.6 grain tablet for each fluid ounce of water, reacts chemically with the escential oils and deodorizes them.



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THE BUILDER OF THE FLYING TRAPEZE

(Continued from page 35)

and less dependable aron pape which show peo-

pic had traditionally used

hor the scon jaw' or teeth act. Van Wyck conveyed the idea of a pigging on which two ne three persons might hang simultaneously by their teeth and revolve for a humanbutterfly" effect. And he has originated variabone of the act

His latest contribution to the tircus art is an nerval contrivance so constructed that three women perform on swinging ladders which revolve around a stationary trapeze on which a fourth performer goes through a routine of acrobatic feats.

STRANGELY enough, most of the Japanese perch poles used by performers from the Orient are made in Van Wyck's abop So are the Roman ladders used by Italian equilibrists, the against gum of French Zouaves, the bounding ropes of East Indus account, and the Australian hoomerang throwers weapons

A Japanese acrobatic troupe came to Van Wyck's shop in Cincinnati with an order for equipment to be used in their act. "I told them I was too busy to make their rigging," Van Wyck said, "Then they asked permission In use my machinery to make their usen propiand I reachly agreed. They set to write and I have never seen better craftsmen. Further every time they left a pile of steel filings or sawdust on the floor, they stopped work to sweep up the mess."

Because he has been a performer himself, Van Wyck understands thoroughly the individual problems of circus prople. That is why they come to him from all parts of the world, confident of his ability to provide what they need. He knows that certain rigging must be perfectly balanced or it will be uneless for the purpose desired. He knows where the greatest strain is everted on various lunds of apparatus. And he never forgets that circus equipment most be attractive in appearance as well as activitizable.

"Many people think," he said, "that there is a trick to every circus act—that equipment in so constructed as to make it easy for a performer to do apparently difficult feats. Unfortunately, perhaps, carcus rigging cannot be made like a magician's properties."

It is true, he explained, that circus equipment is built to aid a performer in doing his particular type of act. Few are the artists, however, who do not risk their lives every time they mount their regging. A trapene bur no which an nexal performer does beel-andtoe catches, for instance, has offurnental bulkon the ends of the bar, which are loaded to make the bar swing evenly and permit better balance than on an ordinary trapese. The artist also wears specially made shoes with padded humps built up behand each heel-but Van Wyck points out that a half-inch pad is not a very substantial safety device when a performer does a twisting somersault out of a trapete to cutch by his beels.

ONE of the most spectacular acts in the tirtus program is that of the tight-wire artist. Yet a light wire is about the simplest piece of equipment made in the shop. Van Wyck constructs all of the wires used by Con-Colleano, the Australian artist, who is the only person who has ever accomplished a furward somersault on the steel strand.

When Colleano needs a new wire, Van Wyck selects a strand of one-fourth-inch English steel, thirty-seven feet long and tested to bear the weight of four persons. Each end of the wire is bent around a cust-aron cyclet, triangular in shape and cast in one of the manufacturer's homemade molds. The loop around the eyelet is made fast by banding with fine copper wire which is solidified by cold soldering, and the finished product is ready

for the arena. "Cold soldering is necessary to prevent the drawing of the temper from the steel," Van Wyck explains. "This is important because, if the wave was heated, it would be subject to

crystallization, which changes the finest steel

into mere pot metal. Crystallization in metals

is the greatest menace to the circus per-COTTOET

THE life of a tight wire depends upon the HE life of a ugar, were supported, Colleano strain to which it is subjected, Colleano discarda his wires every six months because of the strain of his bounding on the strands to obtain momentum for his mid-nir revolutions, "On the other hand," Van Wyck added. "a tight-wire walker came to my shop the other day and boasted that he was still using a wire I made for him seventeen years Hgo,"

"You re crazy to risk your life on that wire, I told him. I explained the danger of crystallization and he said he had never thought of

it. So he ordered a new wire."

And that, Van Wyck said with a wry smile is one of the drawbacks of his business. He makes equipment so durable that his products rarely wear out. The revolving globe on the spinning trapeze, which he made for Ed Millette more than a quarter of a century ago as one of his first contributions to the circus, is still being used every day by Ira Millette, who succeeded his father in the bend-balancing act.

About the most difficult circus property to make, in Van Wyck's opinion, is a rolling globe. Such a globe, a perfect. hollow sphere of white pine, is usually twenty-seven to thirty-alz inches in diameter. The performer balances on the curved surface, rolling the giobe up and down inclines, while doing other feats with his hands, such as juggling or handto-hand halancing with a partner

A giobe is constructed in two sections, fashsoned inside and outside on a la he and the interior covered with tanking glacel to the surface. The two sections are glued together and the completed globe thoroughly sanded and painted in say circus colors. Two weeks of exacting work are required to turn one ou-

Increasing use of cleverly contrived mechanscal devices to aid in the performance of sen-sational feats is predicted by Van Wyck as he looks into the future of the circus. He points out that gymnasts in almost every field of ground and acrial acrobatic work have achieved the heights of mere physical strength, endurance, and agility

"WO of the most semational acts of the I modern circus, be remarked, were made possible only through mechanical devices. One is the shooting of two men, one after another, from a givantic camou by the use of compressed air. Another is the feat of a French woman who leaps from a platform high in the tent to a trapene which breaks, planging her toward the ground. Wires attached to her ankles and to springs on the high platform from which she leaps, snap her back into the air to awing pendulum fashtoo, leaving the audience gasprog.

Even the clowns, who once depended solely upon come songs and later upon pantomame for laugh-provoking effects, have turned to mechanical contrivances. The driverless automobile which cavorts on the hippodrome track to the delight of the kiddles, and trick breyeles which expand and shrink in size as the comedian pedals, are among the ingentous devices that are seen in the modern circus

The ingenuity of the circus mechanic is cast in the hig unseen role of the thrilling acts of today.

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19-35

(Appares)

HERE'S THE ANSWER

(Continued from page 55)

has no bearing on the plant's location with reference to the equator. For example, the common hop and certain honeysuckle plants twine clockwise (viewed from above) while the morning glory and common bean twine counterclockwise. These plants maintain the same twining characteristics north and south of the equator. The direction of the twast is probably determined by geotropic stimuli and other plant forces not yet fully understood

Rise and Fall of Bubbles

O .- why does a soan bubble rise in the air when you first blow it and later sink, if it does not break?-F. B. B., Salem, Oregon.

A-vote breath which blew it was warm and warm air is lighter than cold. As the air in the bubble cools, the bubble becomes heavier and settles to the ground.

A Great Skin Discovery

Q.—Aur. bones and fossils the only remains that have been found of prehistoric animals? -A. C., Frederick, Md.

A .- excavating recently in Wyoming, the American Museum-Sinclair Expedition found great quantities of patches of skin of sauropods (a branch of the dinesaur family). This find is remarkable because the delicate organic skin substance had been preserved for about 140,000,000 years.

These Old Bugs Step Out

B. T. H., EAST CLEVELAND, OHIO. The seventeen-year cleads is probably the longest lived of all insects. After they are batched, they burrow into the ground and attach themselves to tree rootlets. Here they remain, quite motionless, for seventeen years, getting their nourishment from the tree's sap. At the end of this period, they emerge and climb a tree, their skin-encasements split, and the mature cicadas have a brief but noisy adult life of about five weeks.

When Gold Takes Back Seat

Q .- WILLY material commands the highest commercial price on the world markets today?-M. O. V., Albany, N. Y.

A .- exceupeso all items whose values have been enhanced by skilled workmanship and those of great historical or sentimental value, radium is the most costly material in the commerce of the world. It commands a price in excess of \$2,000,000 a troy ounce, which makes it worth about 00,000 times its weight in cold at present standards.

Flights of Flying Fish

M. F. T., TAMPA, PLA. The duration of most of the flights of flying fish, according to recent observations by Carl I. Hubbs of the University of Michigan, are short, lasting only one or two seconds. The longest single flight this authority observed lasted only thirteen seconds; the longest compound (successive leans) slightly less than thirty seconds. Perhaps the record compound flight actually timed is one of forty-two seconds, recorded by a sea cap-

F. or C., It's Forty Below

Q.—is THERE any temperature point at which both the Fahrenheit and centigrade readings would be the same?--H. A. B., Bos-

A .- where it is forty degrees below zero, the temperature readings on both the Fahrenheit and centigrade scales are the same. This is the only temperature at which you need not specify which kind of thermometer you mean.

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Guarding Against Jungle Diseases

(Continued from page 157

further sidelights on the part animals play in spreading disease, I learned that great epidemics may be predicted by watching the behavior of animals. In India, for example, the deadly bubonic plague makes its appearance first among rats and other rodents. Infected fleas from these rats agreed the disease by biting people, and the epidemic is on.

Not lung ago, Public Health Service doctors at Los Angeles barbor conducted a "flea. census" to analyze possible plague conditions there. Hundreds of traps were set at selected points in the harbor. The rats were chloroformed, if still alive, then held over a pan of water while a comb was run through their fur. Fleas thus collected were examined under a microscope, classified, and a "plague map" made showing the location of danger points.

ALL hirds of the parrot family now must be kept in quarantine fifteen days before they may enter the United States, to guard against the entry of paittacoais, or parrot fever. Many unimals are subject to stringent regulations, for infection of our domestic animals invites an outbreak of the disease among men. For example, the strange undulant fever, first noted among goats on the Mediterranean island of Multa, has appeared in the United States among cows, whose milk, containing the byscells abortus germ, spread the infection widely among human beings

Federal port regulations require that all vessels fend off four foot from the dock so that rats ma not jump from or to the ships, Large, circular shields must be slipped on all mooring cables to prevent rats from leaving or boarding ship, tight-rope fashion. Gangways must be lighted at night. Yet, in space of all these precautions, and even though modern marine architecture is eliminating the double buikheads and pipe channels which make convenient nesting places, rats and insect life still exist aboard some ships.

When rodent plagues rage in foreign ports, all vessels from these cities are suspected. Whenever it is deemed necessary, a visual is fumigated. At Los Angeles harbor, I watched fumigating experts as they battened down the hatches of a freighter just arrived with a cargo of corn from Buenos Aires, Although no traces of rats could be found by inspectors, it was necessary to fumigate the ship thoroughly because Buenos Aires was a "quarantine port", plague having been detected there.

Ventilators were plugged with canvas, and masked men released clouds of poisonous gas into the tightly closed hold of the vessel. Workers operating in pairs, with no man ever out of sight of another, strewed small circular disks emitting cyanide gus through each compartment of the vessel. A little tear gas had been mixed with the deadly cyanide to warn against leakage of the masks,

AFTER the hold had apparently been well ventilated to clear it of cyanide gas, the chief furnigation officer and the ship's first mate made a tour of inspection but not until after a cage of white rats had been lowered as sereitive indicators of remaining gas fumes. No rats were visible-only dead cockroaches on galley floors. No disease-bearing creature could have lived through that barrage of lethal

Despite the vigilance of the U.S. Public Health Service and the strong barriers it has set up, I now realized that we must depend more and more on our research workers to combat the danger of epidemics presented by fast transportation from tropical countries. In the days of slow steamships, the disease germs had time to incubate within their bosts and thus betray their presence by characteristic symptoms of illness, Today infected persons or animals can arrive from the tropics days before they themselves know they are sick or the disease can be detected by doctors.

In San Francisco is the Pacific Institute of Tropical Medicine and its director is Dr. Alfred C. Reed, Within this organization, men and women daily push forward in their laboratory quest for more knowledge to thwart the ravages of these disease germs and from this headquarters, more research workers go into the tropies to carry on the fight,

How can we keep our own bugs healthy? That's our biggest problem in the war against invading infection," said Dr. Reed, "If we can prevent these maladies from becoming entrenched among our insect population, we can

handle the human problem.

"Already," he continued, "we have some of the tropical diseases here on as hig a scale as in the tropics themselves. Certain sparsely inhabited desert tections of California, where bubonic plague is raging among ground squirrels and desert rats, rank with the Ganges River valley, the Uganda province of Africa, and parts of Siberia and China, as one of the major plague centers of the earth. Luckily, people in this area are few, else bubonic plague might sweep the country with catastrophic violence. The menace is merely dormant; no one knows when it may break forth

Other tropical diseases that lately have fastened themselves upon the United States, are bacillary dysentery, amochiasis, trichinosis, peliagra, beriberi, undurant fever, and coccidia granuloma, Stal others, particularly the baffling and fatal Chauas disease, are moving stendily northward from the tropics."

TROPICAL jungles abound with countless varieties of microorganisms—bacteria that produce burrible diseases; parasites that bore through the skin and into vital organs; poisonous fungi that grow in the lungs and cause

Slot Machine Massages Feet



JISITORS at the California Pacific Exposition in San Diego, Calif., can gree tired feet a restful oscillation treatment by the use of coin-operated machines installed on the fair grounds

linearing death. They teem with numberless stinging, biting, and sucking insect battalions, known to have spread disastrous epidemics throughout history

From the tropics, valiant experimenters have brought many of these pests to be studied in the laboratory. Here I met Dr. Herbert G. Johnstone, busily engaged in research with the parasite causing onthocerciasis, the blinding disease caused by the awamp mosquitoes of

Central America.

In an adjoining laboratory, Dr. Fac Donat Wood was risking death in her work with a malady for which no cure is known to science. It is the Chagus disease, similar in some respects to the terrible African sleeping sickness but instead of causing sleep, the disease oror the brain with devastating effects upon the

"HE parasite is a tiny, one-colled protosoan. carried by the "kissing bug"-a bloodsucking insect which lives in the nests of wood rats, opossums, and armadillos. This bug is one that might easily be carried by airplanes or automobiles coming from the tropics. Tourists often bring in armadilles as pets, and now and then, a young opossum is found in American fruit markets, curled up in a bunch of bananas.

In her research with the Chagas disease, Dr. Wood went out into the field, looking for American bugs that might be carriers of the disease. She found the "kinsing bug" in all parts of the western United States, Other closely related bloodsucking insects, such as bedbugs, are common to all parts of the country. Each is a potential carrier of the disease-although not yet infected.

Fighting against the possible introduction of this menuce first noted in Brazil and now established in Panama and Honduras, Dr. Wood is patiently working in her laboratory. She risks injection a dozen times daily while handling insects and white mice in-

fected with this incurable disease.

With cultures of the parasites, grown on bits of embryonic heart tissue, she tests the action of various drugs. Already she has found one that will kill the parasite. Will it also kill the enimal whose body harbors the parasite? The answer, soon to be obtained by further experiments, will show whether or not she has found a cure that will wipe out this dreaded

FROM the institute, a part of the University of California's medical school, research workers have gone to all parts of the world to combut leprosy. Recently a dozen doctors went into the jungles of New Guines where the discase had been introduced by Chinese and Hindu immigrants, attracted by the discovery of gold five or six years ago. Meanwhile, pharmarists at the lestitute, cooperating in the leprusy research, succeeded in extracting a powerful drug from the berries of certain Asiatic plants—a substance known as Na-dichaulmoogryl-B-glycerophosphate. This drug may prove to be a potent aid in fighting the disease which every year condemns thousands to a living death.

Long before buffling tropical diseases, borne by advancing insect hosts or by ships of commerce, can begin to take toll of American life, these vignant guardians have made preparations to meet the problems. The American Academy of Tropical Medicine is planning to form a foundation, backed by financial leaders of the country, to attack this growing menace on every front. The during and effective research now being carried on in a few laboratories of the country will be augmented to a strength that no borde of insects or parasites

can withstand.



They tell about Englishman-Who closely scrutinized His income tax blank And then sent it back With the following notation:

"I have given the matter careful thought And have decided not to join The Income Tax,"

Now getting around to cigarettes There are no ifs ands or buts About Chesterfield Two words make everything clear . . .

They Satisfy

Chesterfield ... the eigarette that's MILDER Chesterfield ... the eigerette that TASTES BETTER